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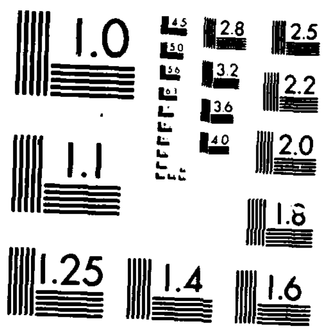

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APPLIED MARINE RESEARCH LABORATORY
OLD DOMINION UNIVERSITY
NORFOLK, VIRGINIA

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COMMERCIALLY IMPORTANT MEROPLANKTON OF THE LOWER CHESAPEAKE BAY AND PROPOSED NORFOLK DISPOSAL SITE. I: BLUE CRABS, ROCK CRABS AND OYSTERS

BY

Arthur J. Butt
Raymond W. Alden III
and
Robert J. Young

Supplemental Contract Report
For the Period Ending September, 1984

Prepared for the
Department of the Army
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510

Under Contract
DACW65-81-C-0051

US Army Corps
Of Engineers
Norfolk District

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Blue crab larvae peak mid to late summer at Bay mouth and NDS. Larval development occurs offshore where megalope concentrate in nueston layer prior to re-invasion of Bay. Rock crab larvae remained in bottom waters at Bay mouth and NDS. Oyster larvae found at Elizabeth/James confluence and infrequently were found seaward.

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By

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INTRODUCTION

Meroplankters are an essential component to the aquatic community structure. In Chesapeake Bay they are typified by larval forms belonging to many benthic and epibenthic species. These include mostly gastropod and pelecypod molluscs, polychaete annelids, decapod crustaceans and fishes. Several of the shellfish are of commercial importance such as oysters (*Crassostrea virginica*), blue crab (*Callinectes sapidus*), and possibly, the rock crab (*Cancer irroratus*).

A very important aspect to any coastal study is the relative abundance, diversity and distribution of such organisms and the impact that urbanization may have on commercially important forms. This impact is of particular interest in a port such as Hampton Roads where the economy is strongly influenced by aspects of commerce, defense and fisheries.

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The present study was designed to provide a descriptive evaluation of the population dynamics of commercially important invertebrate meroplankton of the Hampton Roads, lower Chesapeake Bay and proposed Norfolk Disposal Site (NDS). These invertebrate populations from representative stations in these regions were sampled with respect to age, abundance, and spatial and temporal distributions.

Blue Crabs and Rock Crabs

Two crab species with commercial importance are collected in or around Chesapeake Bay. The blue crab, *Callinectes sapidus* is the Bay's dominant fisheries crab. The 1983 dockside landings of this species exceeded $11 million, representing one of Virginia's most important fisheries. The Chesapeake Bay industry alone produces between 40-50% of the total United States catch. This fishery is split into two types, based on season (winter vs. summer) and migration of the species. The other, less common, species is the rock crab, *Cancer irroratus*. Although its monetary value is difficult to estimate, its potential harvestable value warrants consideration. Because of the migratory life histories of these two species, the lower Chesapeake Bay and offshore regions along the Virginia coast are believed to be among the most important spawning and recruitment centers in the Mid-Atlantic Bight.

The biology, life history and distributions of the blue crab has been described by many authors. However, the generally accepted consensus was presented by Van Engle (1958). Mating occurs from May to October in the mid-Bay. Spawning follows the female migration to a region of the Bay mouth between Cape Henry and Cape Charles. The females prefer deep water associated with the channels and a significant number of crabs also occur outside the Bay mouth.

Two major spawning periods are noted. The first occcurs in May - June and a second in August - September. The spring spawnings are from females that mated and matured the previous fall. They may spawn a second time at summers end. The females reaching maturity in May spawn in August. By mid-September no female spawners are found. Post-spawning crabs are thought to move to deeper waters of the bay or the coastal zone and re-invade the estuaries as "ocean" crabs the following year (Van Engle, 1958).

A two week development is generally required between egg laying and hatching (Van Engel, 1958). Growth is rapid and complete metamorphosis is reached within 40 days of hatching (Costlow and Bookhout, 1959). The larvae develop through as many as eight zoea stages and a megalopae during this period.

The larvae hatch synchronously with the tidal cycle just prior to maximum ebb (Provenzano et al., 1983). Provenzano et al. (1983), and McConaugha et al. (1983) reported maximum first stage zoea concentrations in the surface layers of waters near the mouth the of Bay where they are transported offshore. The megalopae molt into an early crab stage which may re-invade the Bay through wind-driven surface circulations.

The rock crab is caught commercially in the colder waters of the Northeast (Krouse, 1972). In the Mid-Atlantic Bight, C. irroratus is a common epibenthic species along the continental shelf and

inshore waters (Musick and McEachran, 1972); however, they are caught incidentally in other fisheries. Large numbers of rock crabs are caught in the winter dredge fishery for blue crabs that extends from December through March each year. They may appear in the markets along with blue crabs although dredgers generally avoid areas of rock crab abundance. Since they are underexploited, the life history and biology of the rock crab off Virginia is not well known. A review of the available data on these crabs is given by Bigford (1979).

Larvae are produced from early spring through the summer (Connolly, 1923; Sandifer, 1972). Sastry (1970, 1971) reported growth rates for the five zoea and one megalopae stages to be comparable to those for the blue crab (37-58 days in a constant temperature culture regime). Sandifer (1972) and Goy (1976) reported larval abundance of the rock crabs during April and May. The greatest catches were associated with their more seaward stations just outside the Bay mouth. Previous reports has been made of large numbers of larvae in the surface waters (Fish, 1925; Smyth, 1980); however, Sandifer and Goy found that 55% and 72%, respectively, of the larvae they collected to be in the bottom collections.

Bigford (1979b) concluded from laboratory data that late stage zoea and megalopae are epibenthic; however, Johnson (1982) found an opposite trend for megalopae. He reported the megalopae

inhabiting the neuston in stratified water columns, while a mixed vertical distribution did occur in homogeneous water columns.

Bivalves and Oysters

Bivalve larvae constitute a major portion of the marine plankton community (Thorson, 1946). In fact, during bivalve spawning periods, their abundance in the water column may dominate the other plankters. Unfortunately, proper identifications of many planktonic bivalve larvae are lacking since true definitive characteristics and meristic distributions common to the mature stage are often logistically difficult, if not impossible to detect.

Chesapeake Bay serves as a major habitat for many bivalves (Table 1); several of which are of commercial value. The hard and soft clams, *Mercenaria mercenaria* and *Mya arenaria*, respectively, experience moderate exploitation. The oyster, *Crassostrea virginica* has the largest commercial value for mollusc harvested in the Bay, with a 1982-83 landing exceeding $1 million for the James River (Table 2). Its development is well documented and the larvae are distinct (Chanley and Andrews, 1971).

The harvest of oysters from the lower Chesapeake Bay and James River is composed of two fisheries: 3" market and seed market. The standard beds are tonged for the adults (3" market) and are sold by the bushel as "clean cull". Unique to the James River oyster farming is the seed market. It is important as the source of seed-oysters for the entire oyster industry of Virginia.

TABLE 1. Spawning seasons in Virginia of 23 species of bivalves from Chanley and Andrews, 1971.

```
     Species                Jan    Feb    Mar    Apr    May    Jun    Jul    Aug    Sep    Oct    Nov    Dec

Aequipecten irradians                                   ------- - - - - - - - - -
Anadara transversa                                        - - - - - - - - - - - - - - - -
Anomia simplex                                          - - - - -------------------------- - -
Barnea truncata                                   -----------------------------------------------------
Crassostrea virginica                                   ---------------------------------------
Cyrtopleura costata                               - - - - - - - -------------   - - - - - - - - - - - -
Donax variabilis                                                   ------------------------
Ensis directus                     -------------------
Gemma gemma                               - - - --------------------- - - - - - - - - - - -
Laevicardium mortoni                      - - - --------- - - - - - - - - - - -----------  - - -
Lyonsia hyalina                           ----- - - - - - - - - - -
Mercenaria mercenaria                                    --------------------------------------
Modiolus demissus                                        --------------------------------------
Mulinia latervalis                       ------------------------------------------ - - - - - -
Mya arenaria                             - - - - - - - - - -                        ----------- - - - - - - -
Mytilus edulis              - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Noetia ponderosa                                                   --------------------------------
Petricola pholadiformis                  ---------------------------------------- - - - - - - - - - - -
Pitar morrhuana                                        - - - - - - - - - -
Spisula solidissima                       ----------------- - - -                    - - - - - - - - -
Tellina agilis                                    ------------ - - - - - - - - - - -
Teredo navalis                                                   ----------------------------------

                                     - - - - - - - = Estimated
                                     ----------- = Known
```

TABLE 2. James River Public Oyster production based on dockside landings and estimate values (VMRC, 1984).

Fiscal Year Oct - Jun	# Bushels Seed	Seed Average Price/Bushel	Total Seed $ Value	# Bushels Clean Cull*	Clean Cull Average Price/Bushel	Total Clean Cull $ Value	Total Seed & Clean Cull Value Dockside
1962-63	843,833	$1.25	$1,054,791	175,695	$4.25	$ 746,704	$1,801,495
1963-64	829,650	1.25	1,037,063	417,375	4.25	1,773.844	2,810,907
1964-65	424,234	1.25	530,293	449,991	4.25	1,912,462	2,442,755
1965-66	611,167	1.25	763,959	487,937	4.24	2,070,099	2,834,058
1966-67	532,590	1.24	661,192	166,989	2.35	392,598	1,053,790
1967-68	483,690	1.42	687,925	182,020	2.55	463,911	1,151,836
1968-69	486,536	1.46	712,643	157,669	2.55	401,806	1,114,449
1969-70	264,203	1.93	509,945	143,778	2.59	372,035	881,980
1970-71	458,637	1.53	702,112	170,844	2.64	450,286	1,152,398
1971-72	400,593	1.88	755,080	129,716	2.48	321,181	1,076,261
1972-73	396,169	2.04	808,979	27,389	2.54	69,639	878,618
1973-74	372,537	2.35	877,236	186,290	2.57	478,808	1,356,044
1974-75	317,002	1.89	597,563	61,601	2.54	156,572	754,135
1975-76	446,121	1.88	839,205	14,633	2.18	31,877	871,082
1976-77	420,403	1.51	634,945	3,302	3.36	11,091	646,036
1977-78	350,419	1.98	694,391	13,192	5.00	66,009	760,400
1978-79	419,465	2.25	945,522	42,670	5.45	232,517	1,178,039
1979-80	349,538	2.38	830,948	68,354	5.23	357,748	1,188,696
1980-81	214,313	2.28	488,633	135,967	4.97	676,247	1,164,880
1981-82	406,042	2.24	911,292	24,924	7.92	197,508	1,108,800
1982-83	487,438	2.08	1,014,312	12,301	8.52	104,767	1,119,079

* Clean cull = 3" + market size

Information accumulated over the past seven decades indicates that larvae of Crassostrea virginica migrate in conduction with current and tidal oscillations. Oyster larvae are generally retained within the spawning area of the estuary and may settle in areas upstream from the major spawning population. Such is the case in the James River where larvae along the northeast shoal and deeper channels are transported upstream. Those larvae in the southwest shoal waters are carried seaward (Wood and Hargis, 1971).

Nelson (1911) first hypothesized that oyster larvae control their vertical distribution by rising and sinking in the tidal streams. Numerous studies have confirmed that the larvae are not being transported passively, but, in fact, selectively swim in to maximize horizontal distributions.

The data suggest that their behavior is correlated with salinity and tidal movement. In studies where sharp salinity stratification was reported, the greatest abundance of the larvae was found just above the zone of greatest salinity change during flood tide. Large or older oyster larvae tend to rest near or on the bottom during ebb, and actively rise in the water on the flood. This allows for maximum distribution in the tidal headwaters during a tidal cycle. Where a halocline was not reported the oyster larvae were found in the vicinity of the fastest current (see Carriker, 1981, and Woods and Hargis, 1971, for reviews).

METHODS

Study Area

Chesapeake Bay and its tributaries constitute the largest estuary in the United States. It is characterized by a two-layer circulation pattern with a net outflow of low salinity surface water layered over a net inflow of more dense, higher salinity bottom water (Pritchard, 1955; Boicourt, 1981). There is an inflow of shelf water at the Chesapeake Channel and North Channel. Due to the Bay's size, the Coriolis force helps confine this higher salinity water to the western shore. The major fresh water sources experience an outflow toward the southern channel. This pronounced low salinity plume has a general southerly drift (Boicourt, 1973, 1981; Johnson, 1976). Once outside the Bay mouth, this water flows with the southerly drift of shelf water; however, it is highly susceptible to directional changes caused by prevailing seasonal winds.

Sampling Regime

Ten stations were sampled in the lower Chesapeake Bay and one station offshore at the proposed Norfolk Disposal Site (NDS) during 1982 and 1983 (Figure 1). The lower bay stations extended from the southern channel at Cape Henry along Thimble Shoal Channel to the river mouths of the James and Elizabeth Rivers and their confluence. Three additional stations were sampled across the Bay mouth at the middle (Chesapeake Channel) and upper (North

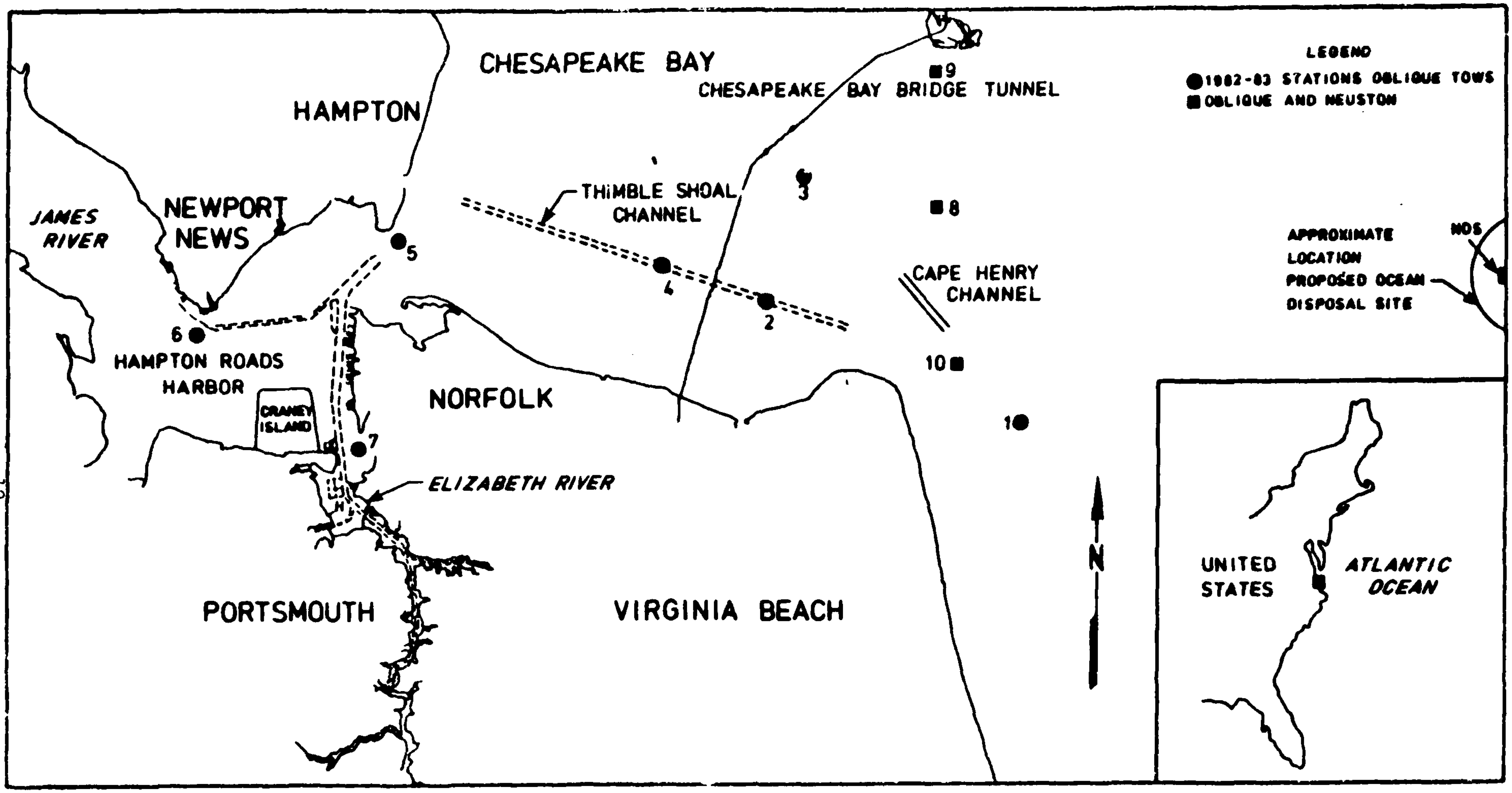


Figure 1. Study Area - Lower Chesapeake Bay, Chesapeake Bay Mouth and Proposed Norfolk Disposal Site (NDS).

Channel) navigational channels. The NDS station was placed 27 km east of the Bay mouth in the center of the proposed dredged material disposal site.

A monthly sampling was maintained for the Bay mouth transect (stations 8, 9 and 10) and NDS. The two southern channels of the Bay mouth were sampled semi-monthly (stations 1, 2 and 3). The four inner most stations (4, 5, 6 and 7) were sampled monthly during October through April and semi-monthly from May through September. The semi-monthly sampling was deemed necessary in order to monitor the changes in population dynamics during the more active spawning periods and depict any major population shifts associated with Bay plume affects.

Plankton samples were collected with oblique bongo tows from approximately one meter above the bottom to the surface. Each station was sampled with a replicate tow. The duplicate sequence repeated with a different mesh net producing a total of 8 samples per station. The smaller 153 u mesh was used for bivalve larvae and the large 355 u mesh for larval decapods. A one-meter neuston net (355 u) was deployed at stations 8, 9, 10 and NDS. Four neuston tows were made per station, of five minutes duration each. Mechanical flow meters were used in each net during all samples collected. Abundances were calculated as $\#/m^3$ and plotted on a log +1 scale.

Field parameters measured included salinity, temperature, conductivity and dissolved oxygen. Readings were made at each station one meter below the surface and one meter above the bottom. These supplementary data are available from the authors.

RESULTS

Abundance analysis for all stations sampled shows significant spatial and temporal patterns for the three larval species studied. Blue crab larvae exhibit more dynamic larval dispersal and recruitment mechanisms. The rock crab and oysters retain spawning behavior that allows the retention of larval in an environment endemic to the parental stock. Spawning of blue crabs and oysters occurs during the summer month, while the rock crab spawns during cooler periods.

Blue Crab

Spawning of blue crabs over the two year study was concentrated around the Bay mouth and offshore (NDS) (Fig. 2). Initial low level spawning activities were evident by late May - early June at the lower Bay mouth (Stations 1, 2 and 10). By late June, July and August, major spawning peaks occurred throughout the Bay mouth. Greatest zoeal abundances were from the deeper channels at the Bay mouth and NDS stations with concentrations exceeding 300 larvae/m^3 in July (Station 9, 1982) and August (Station 1, 1983). The single largest recorded abundance was at NDS on August 11, 1982 when over 700 crab larvae/m^3 were collected. Blue crab larvae were found as late as November at NDS; however, the Bay mouth concentrations appeared to have ended by September.

Blue crab larvae were collected during the summer months from the

James River/Elizabeth River (Stations 6 and 7, respectively). However, larval abundances declined sharply with distance inland from the Bay Mouth (Fig. 2 h, i, j, & k).

Megalopae of the blue crab were present at Stations 1, 3 and NDS during July and August; however, their numbers were low in the oblique tows (Fig. 3). Few were collected at the otter Bay mouth or inner stations.

Rock Crab

Rock crab larvae were absent from the plankton during the summer months (Fig. 4). Larvae were reported in oblique tows as early as August and extended through May with peak abundances at NDS during April for both years studied. The Bay mouth showed substantially lower numbers; of those sampled, Stations 1, 2, 3 and 10 were the popular areas. Only a few zoea were collected at the the James River and Elizabeth River stations.

The megalopae were rarely captured; (see Appendix tables), however, they appeared to remain with the zoea in the offshore shelf waters.

Oysters and Bivalve Larvae

Oyster larvae contribute little to the total bivalve population outside their parental habitats of the James/Elizabeth Rivers mouth confluence (Fig. 5). Oyster larvae were seldom collected

east of the Chesapeake Bay Bridge Tunnel (Stations 2 and 3). Abundance values for oysters at the Bay mouth stations (Stations 1, 8, 9 and 10) and the NDS are not shown due to such low abundances. The bivalve population in general was highly variable over the two years, with highest concentrations noticed in April through July. This is a brief span considering the abundance of benthic bivalves spawning during the summer months (Table 1). Otherwise no noticeable trend could be seen.

Near the inner most stations (4, 5, 6 and 7) the oyster larvae abundance was very patchy (high variability). During the summer spawning of oysters, their larvae accounted for most of the bivalve larvae in the plankton, particularly near the inner stations along the James River oyster beds. There was a peak abundance of oyster larvae during July and August in 1982; however, a bimodal distribution was evident the following year. There was an initial peak in June and July, followed by a decline in mid-August and a resurgence in early September. The bivalve larvae in general showed a similar trend.

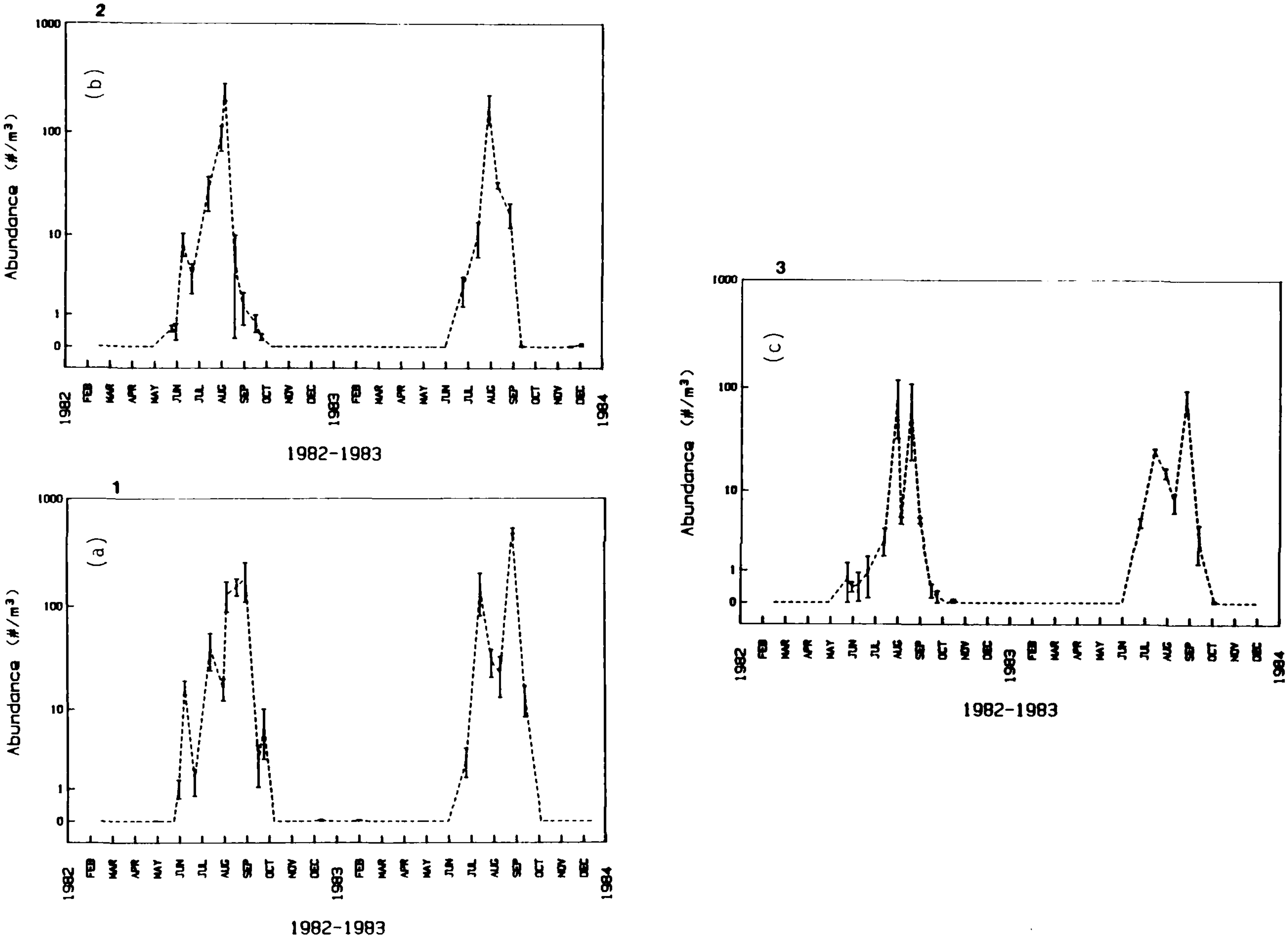
Vertical Distribution

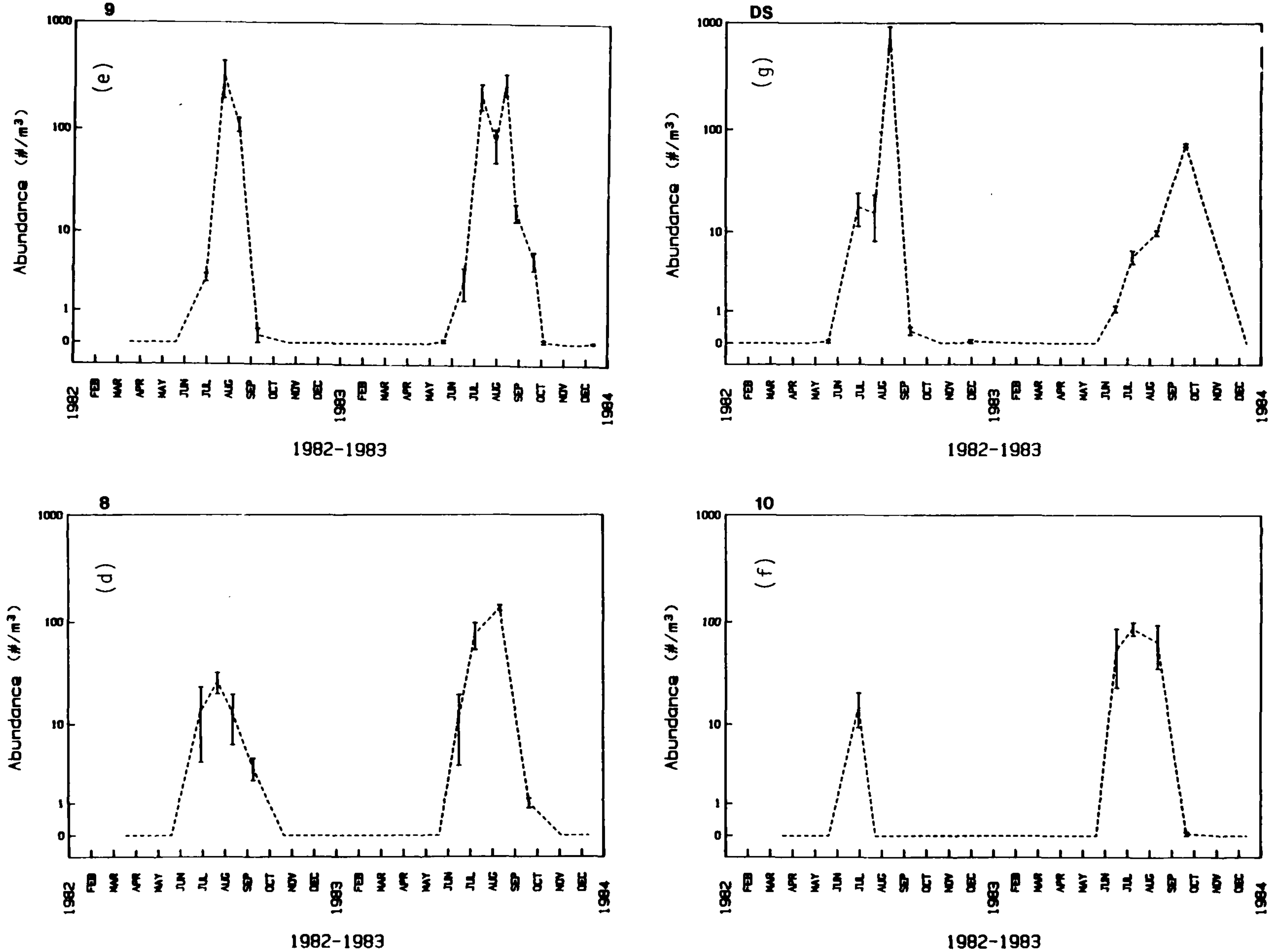
No definitive pattern of vertical stratification was noticed for blue crab zoea at the Bay mouth and NDS stations over the two year study (Fig. 6). Station 8 showed no difference between neuston and obliques in 1982, however, zoea abundances were substantially higher in obliques in 1983. A similar pattern was noticed for

Station 9. They dominated the neuston in late summer at Station 10 in 1982; however, the reverse was noticed the following year. There was no distinction between obliques and neuston at NDS for 1982. In 1983, the zoea appeared in the neuston early in the season; however, by the end of the summer (September and October) the larvae were throughout the water column. Blue crab megalopae showed a definite preference for surface waters at the offshore station (NDS) (Fig. 7). Megalopae concentrations at NDS were robust during 1982, but were significantly reduced the following year.

Rock crab zoeae were seldom collected in the neuston layer, whereas the oblique tows showed higher concentration at NDS (Fig. 8). This indicates a selective preference for the colder, bottom waters. This zone is characteristic of higher saline coastal waters influenced by a surface layer of less dense estuarine waters. The numbers of megalopae collected were too few for any definiative comparison (see Appendix).

Figure 2. Abundance (#/m^3) of **Callinectes sapidus** zoea from oblique tows (355 u mesh) at the Bay mouth stations: east of the Bridge Tunnel - 1(a), 2(b), 3(c), 8(d), 9(e), 10(f); offshore - NDS (g); and the inner stations - 4(h), 5(i), 6(j), and 7(k).


2
(b)
Abundance (#/m³)
1982-1983
1
(a)
Abundance (#/m³)
1982-1983
3
(c)
Abundance (#/m³)
1982-1983



9
(e)
DS
(g)
8
(d)
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(f)
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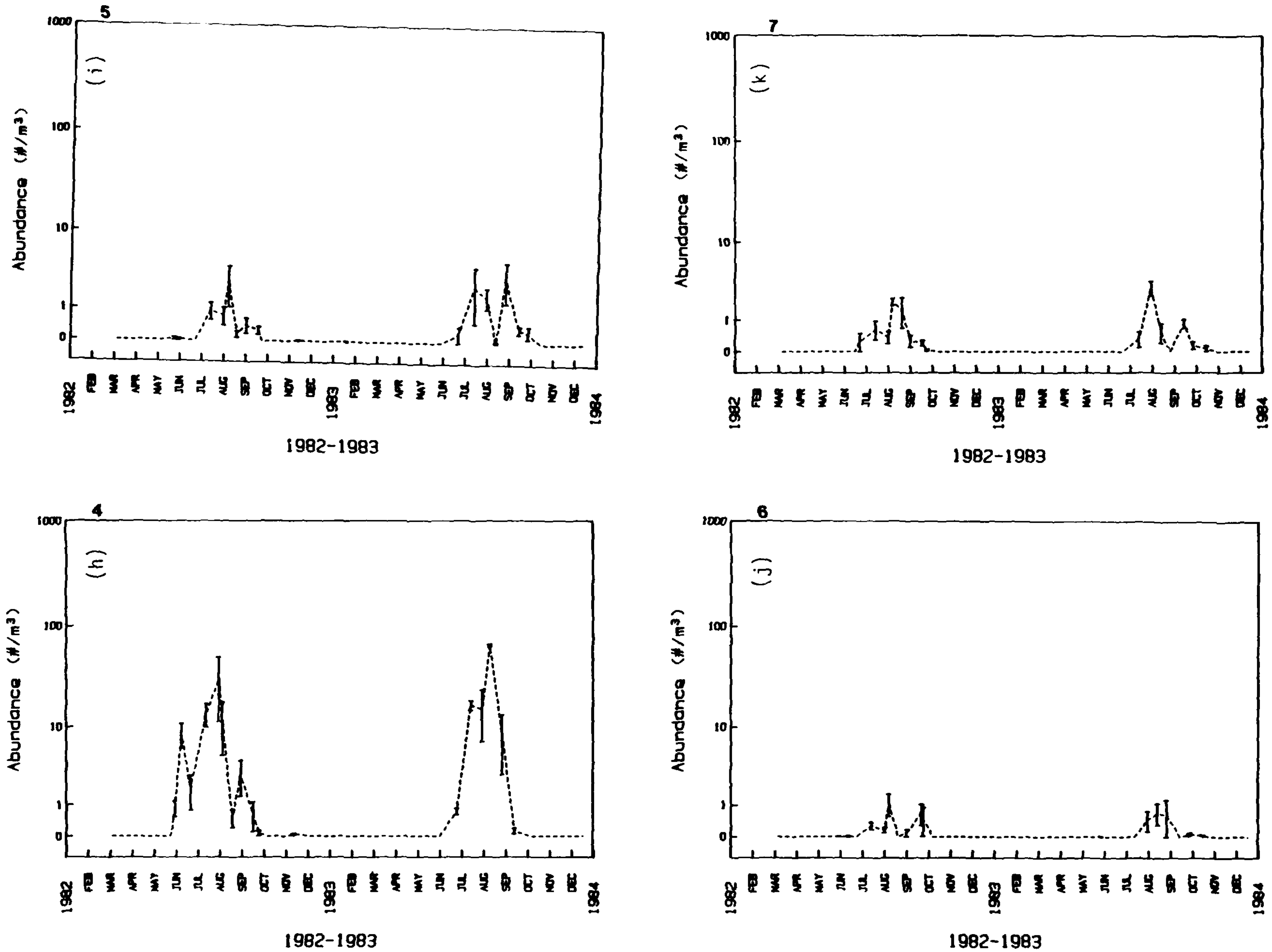

5
(i)
Abundance (#/m³)
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0
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1982-1983
7
(k)
Abundance (#/m³)
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1
0
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Abundance (#/m³)
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1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
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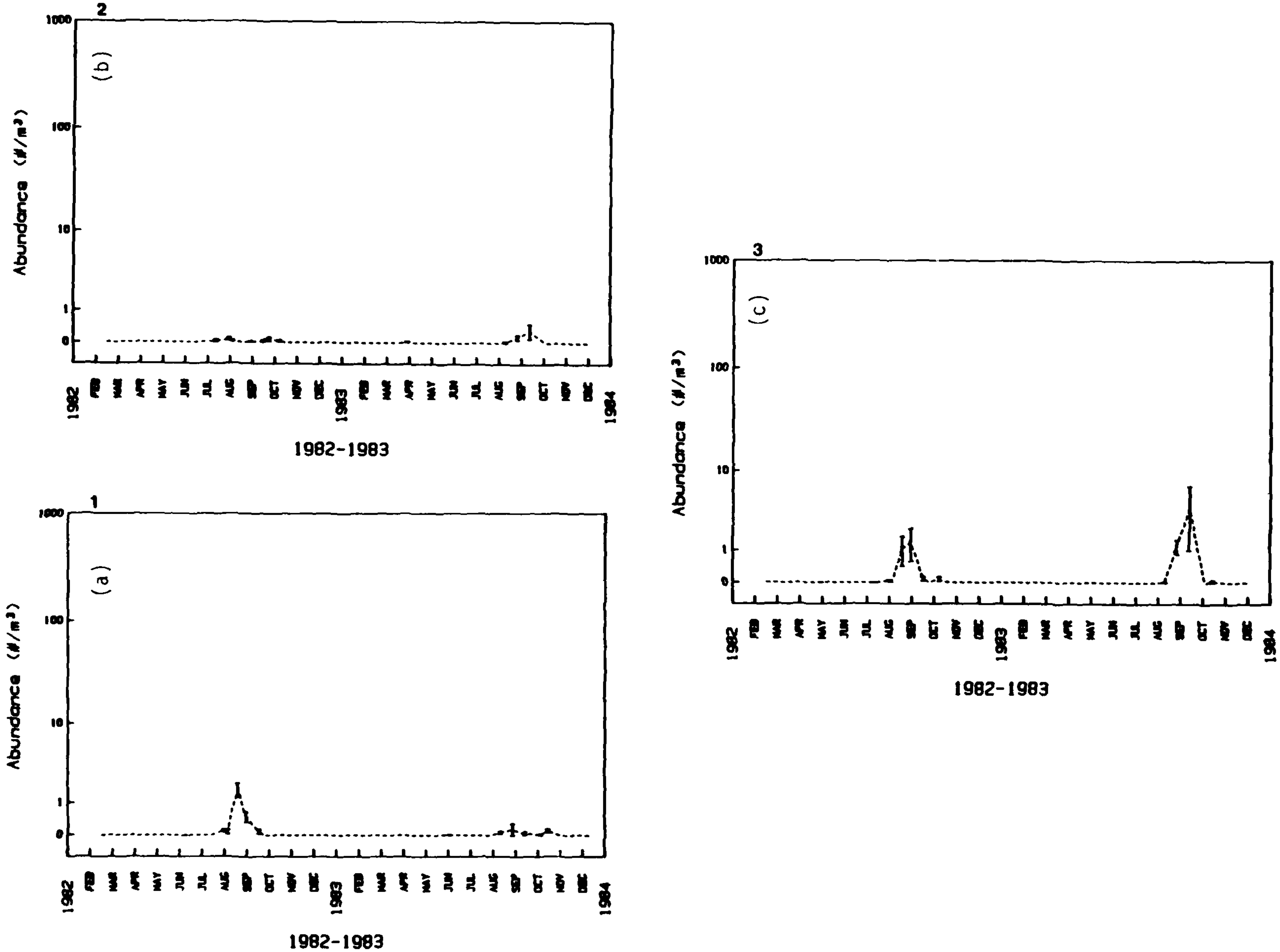
1982-1983



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Abundance (#/m³)
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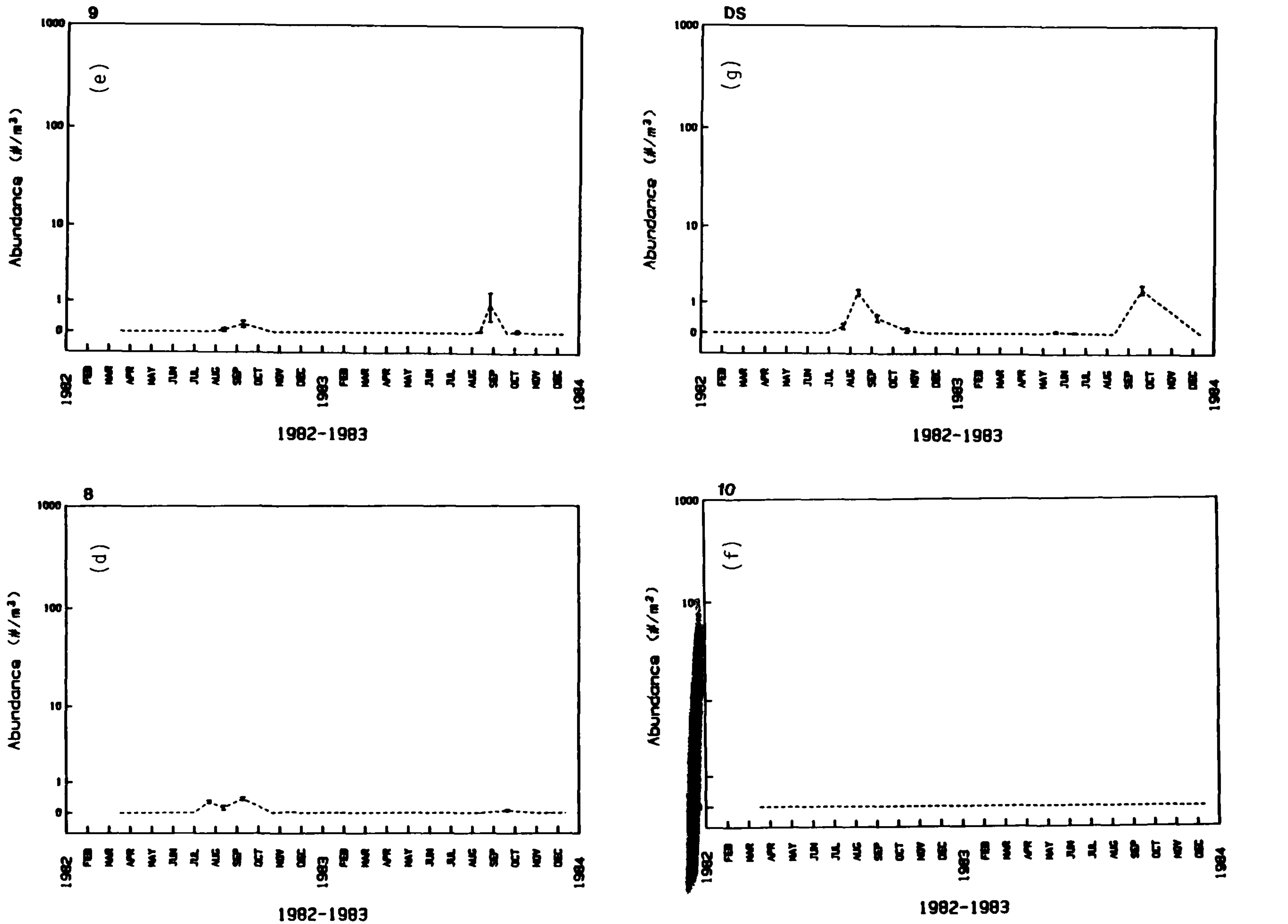
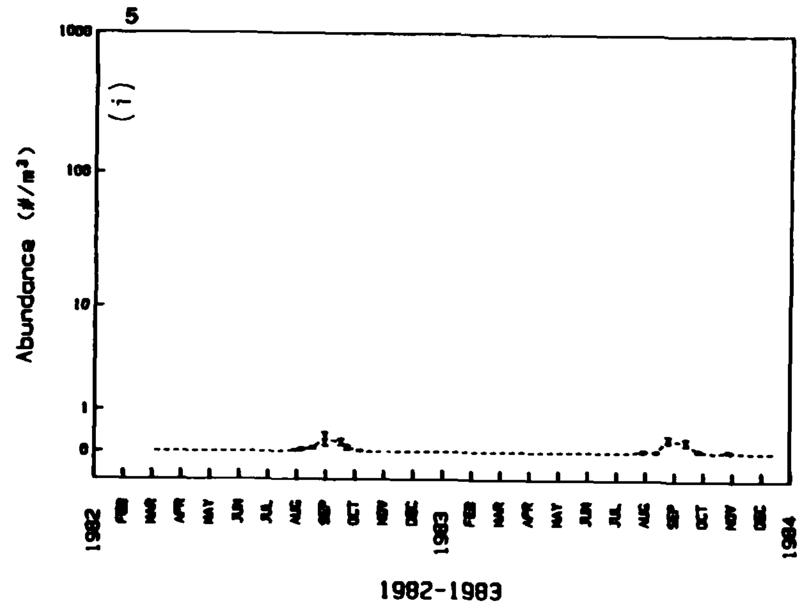
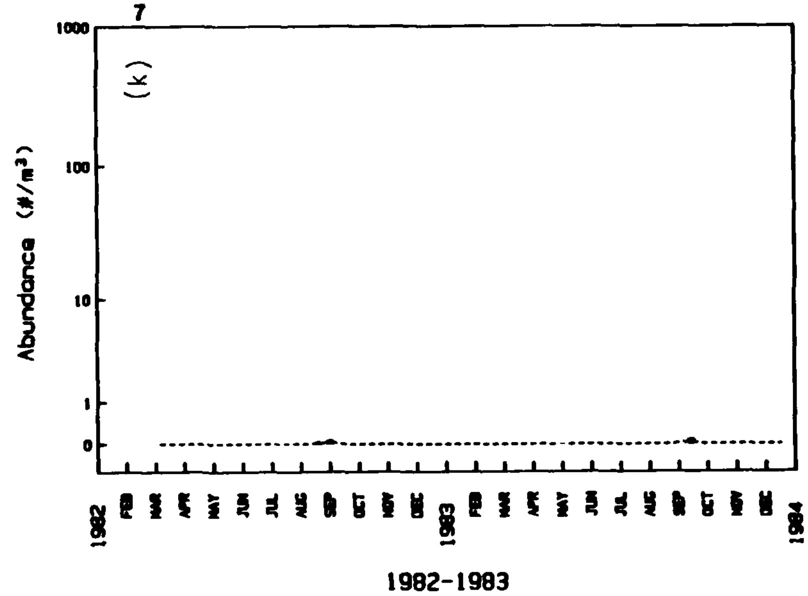
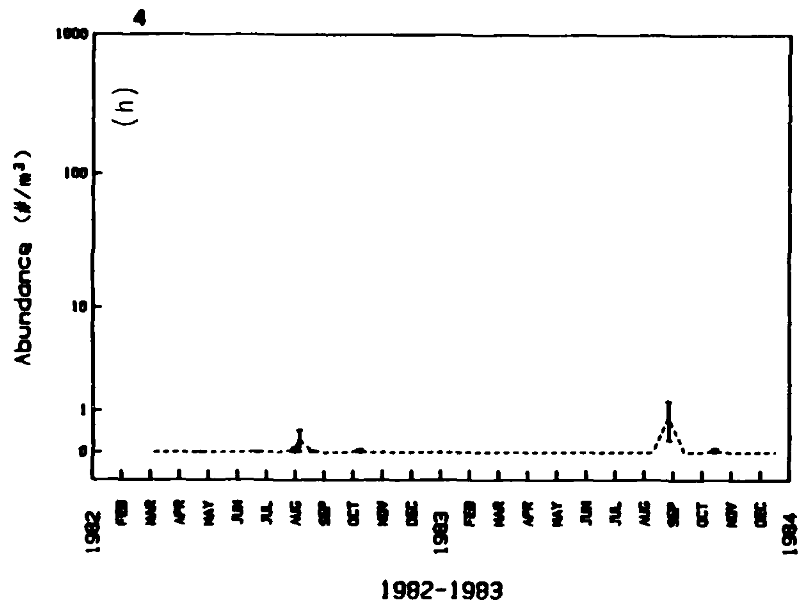
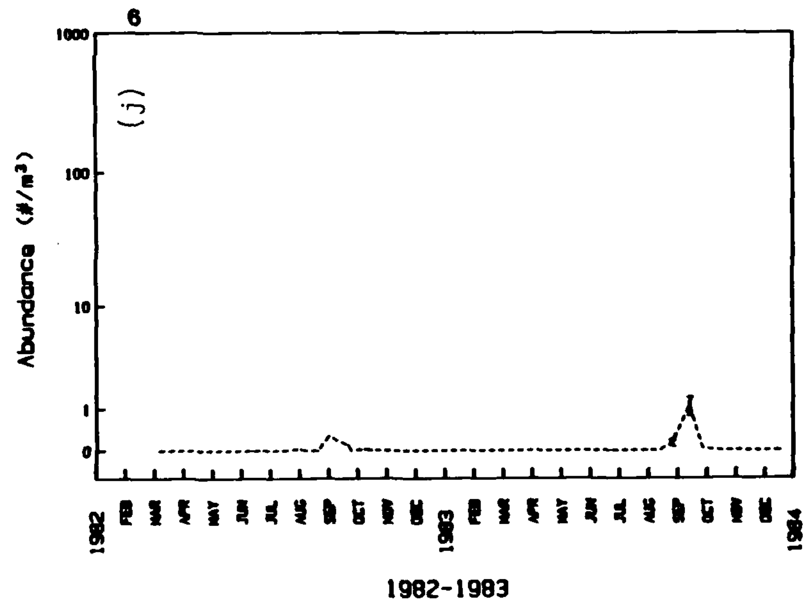


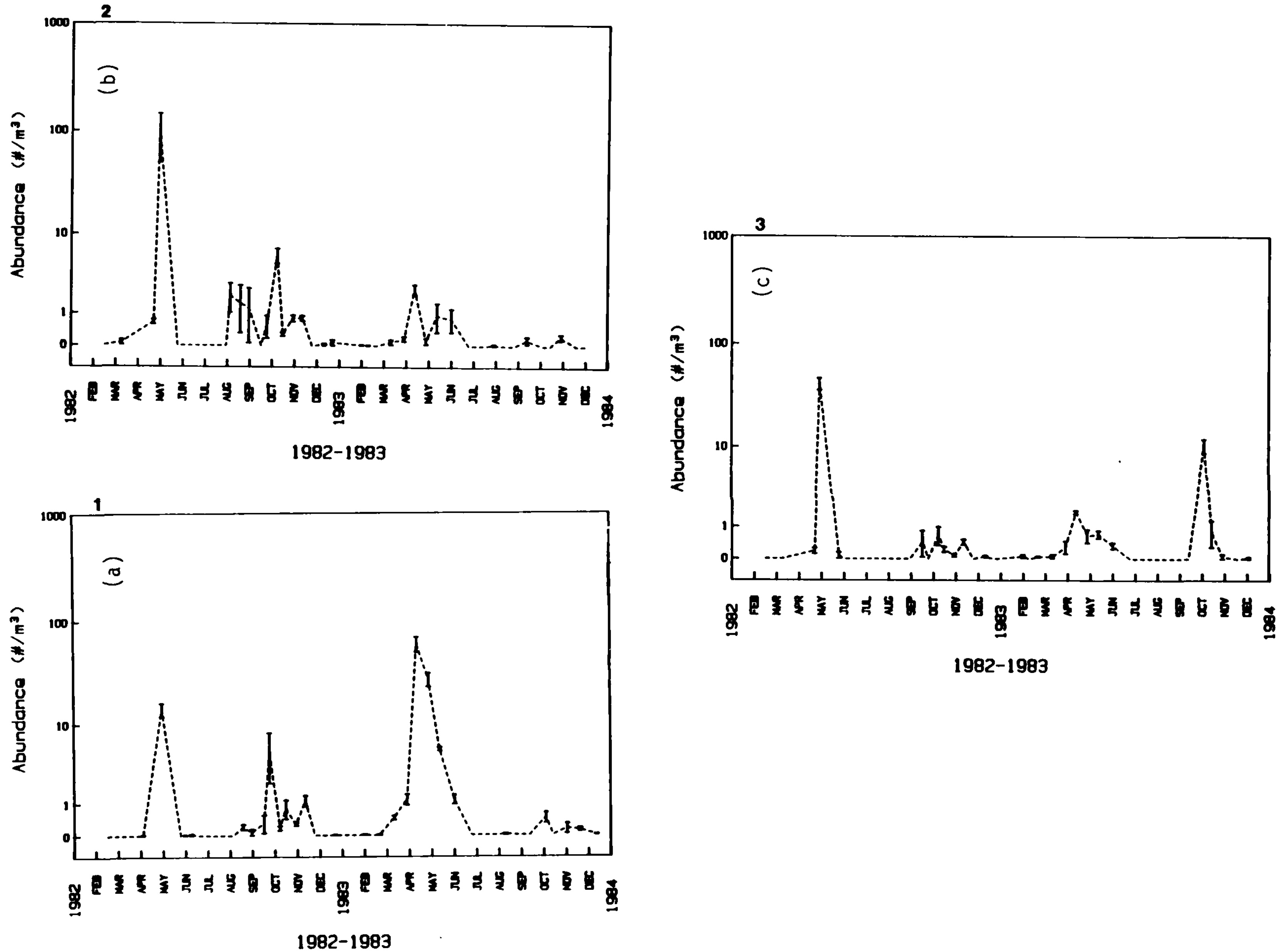
9
(e)
Abundance (#/m³)
1000
100
10
1
0
1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
1982-1983
DS
(g)
Abundance (#/m³)
1000
100
10
1
0
1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
1982-1983
8
(d)
Abundance (#/m³)
1000
100
10
1
0
1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
1982-1983
10
(f)
Abundance (#/m³)
1000
1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
1982-1983

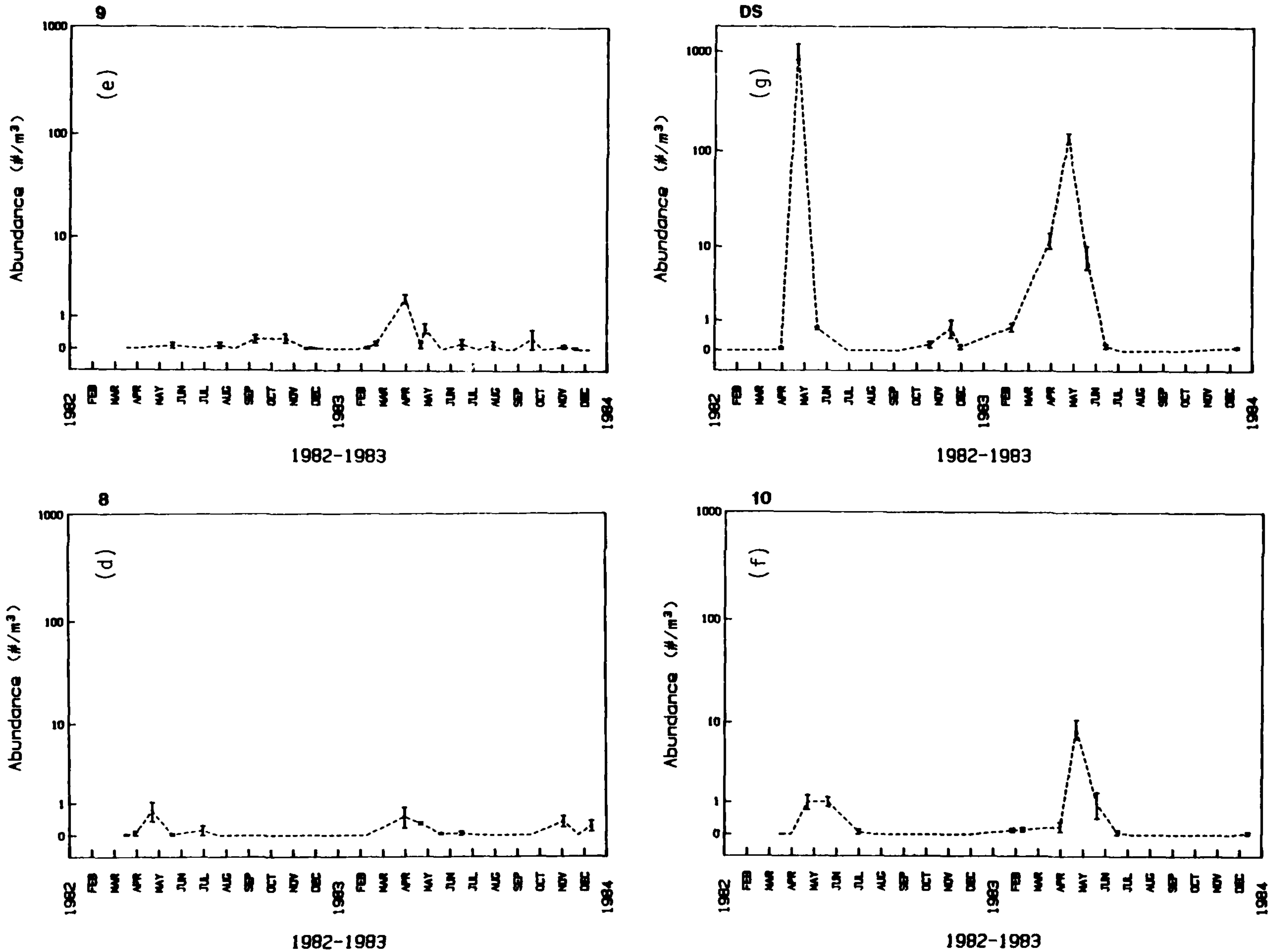

5
(i)
Abundance (#/m³)
1000
100
10
1
0
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
1984
1982-1983

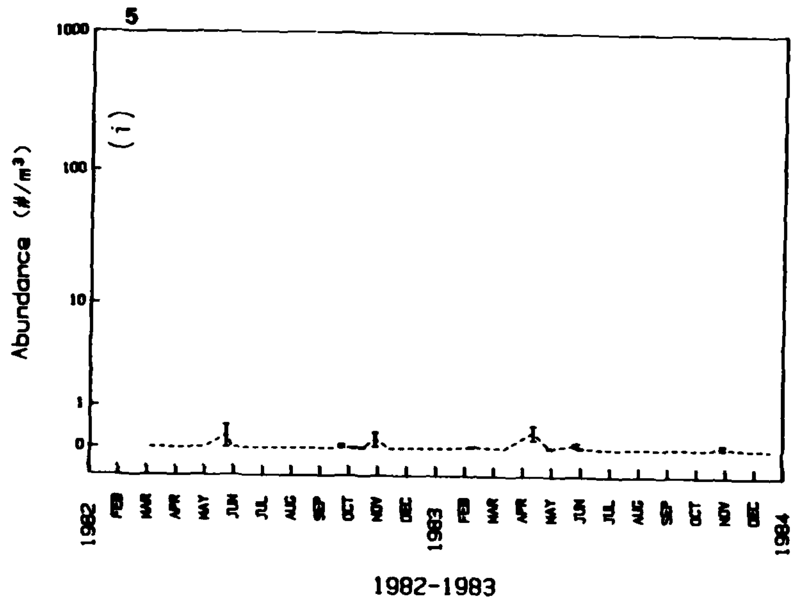

7
(k)
Abundance (#/m³)
1000
100
10
1
0
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
1984
1982-1983

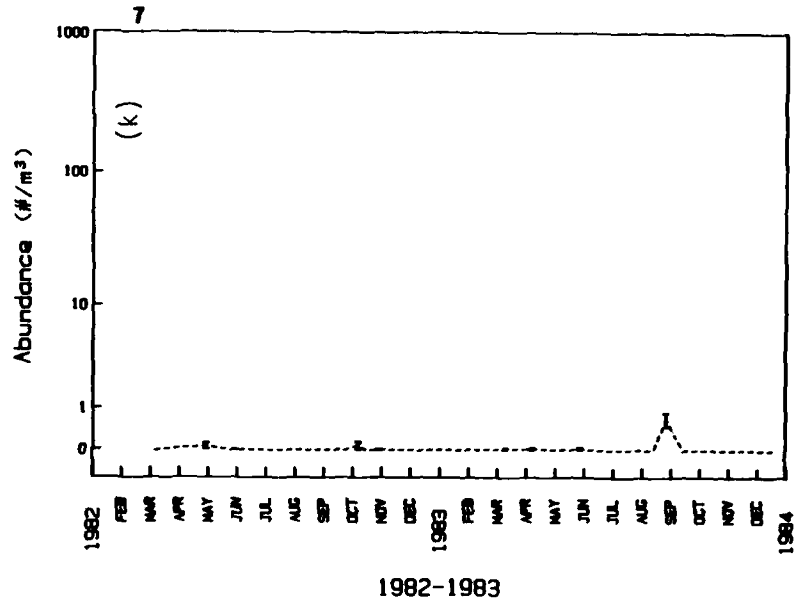

4
(h)
Abundance (#/m³)
1000
100
10
1
0
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
1984
1982-1983

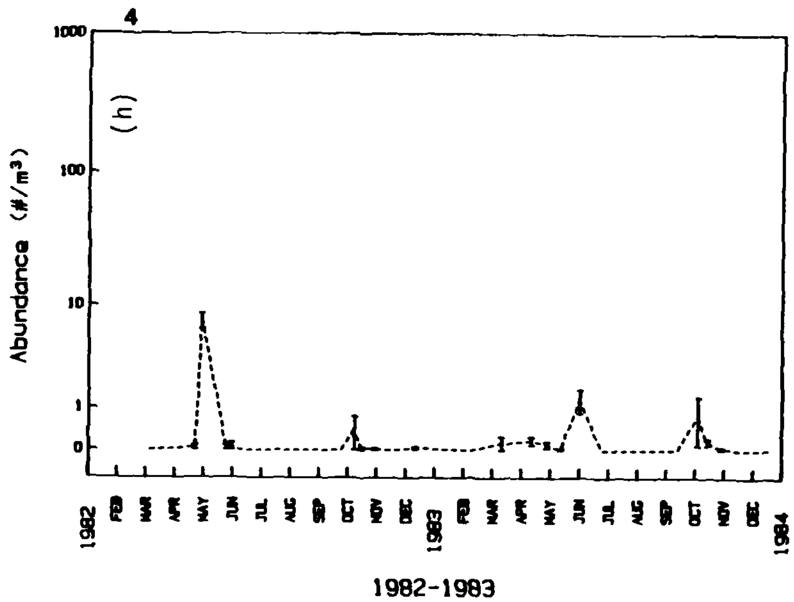

6
(j)
Abundance (#/m³)
1000
100
10
1
0
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
1984
1982-1983

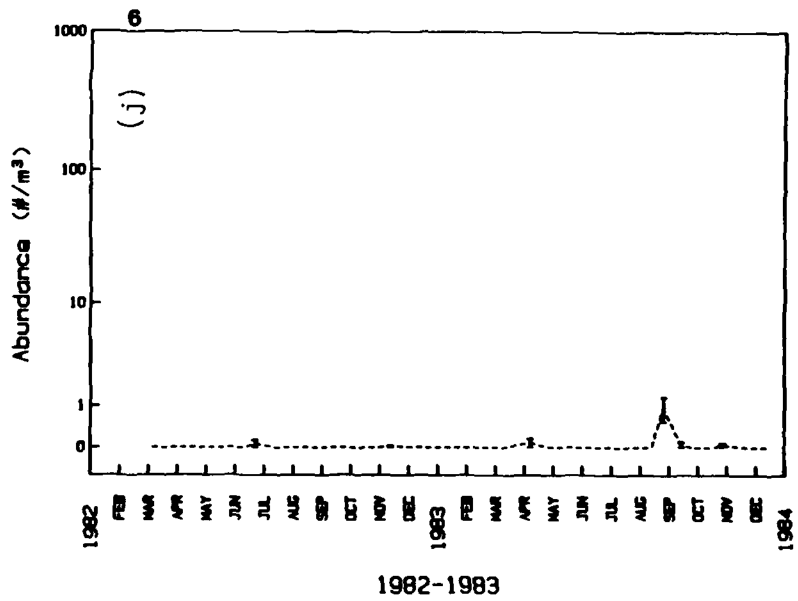

2
(b)
Abundance (#/m³)
1000
100
10
1
0
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1984
1982-1983
1
(a)
Abundance (#/m³)
1982-1983
3
(c)
Abundance (#/m³)
1982-1983

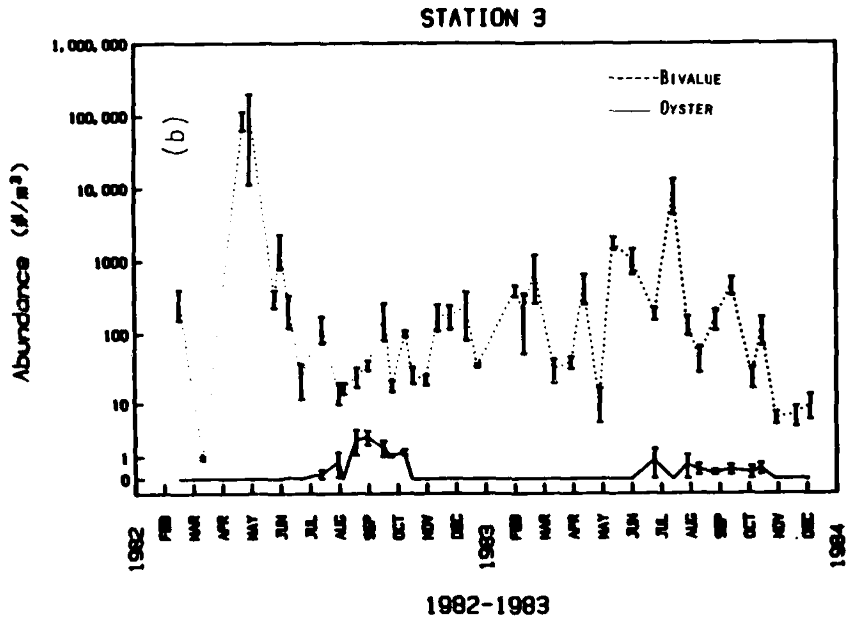

9
(e)
DS
(g)
8
(d)
10
(f)
Abundance (#/m³)
1000
100
10
1
0
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
1984
1982-1983


5
(i)
Abundance (#/m³)
1000
100
10
1
0
1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
1982-1983

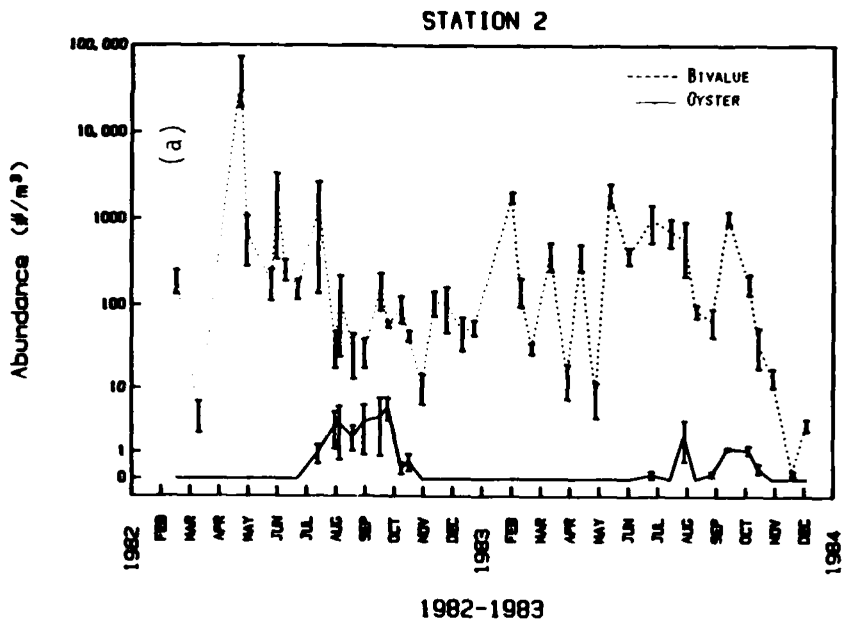

7
(k)
Abundance (#/m³)
1000
100
10
1
0
1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
1982-1983


4
(h)
Abundance (#/m³)
1000
100
10
1
0
1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
1982-1983

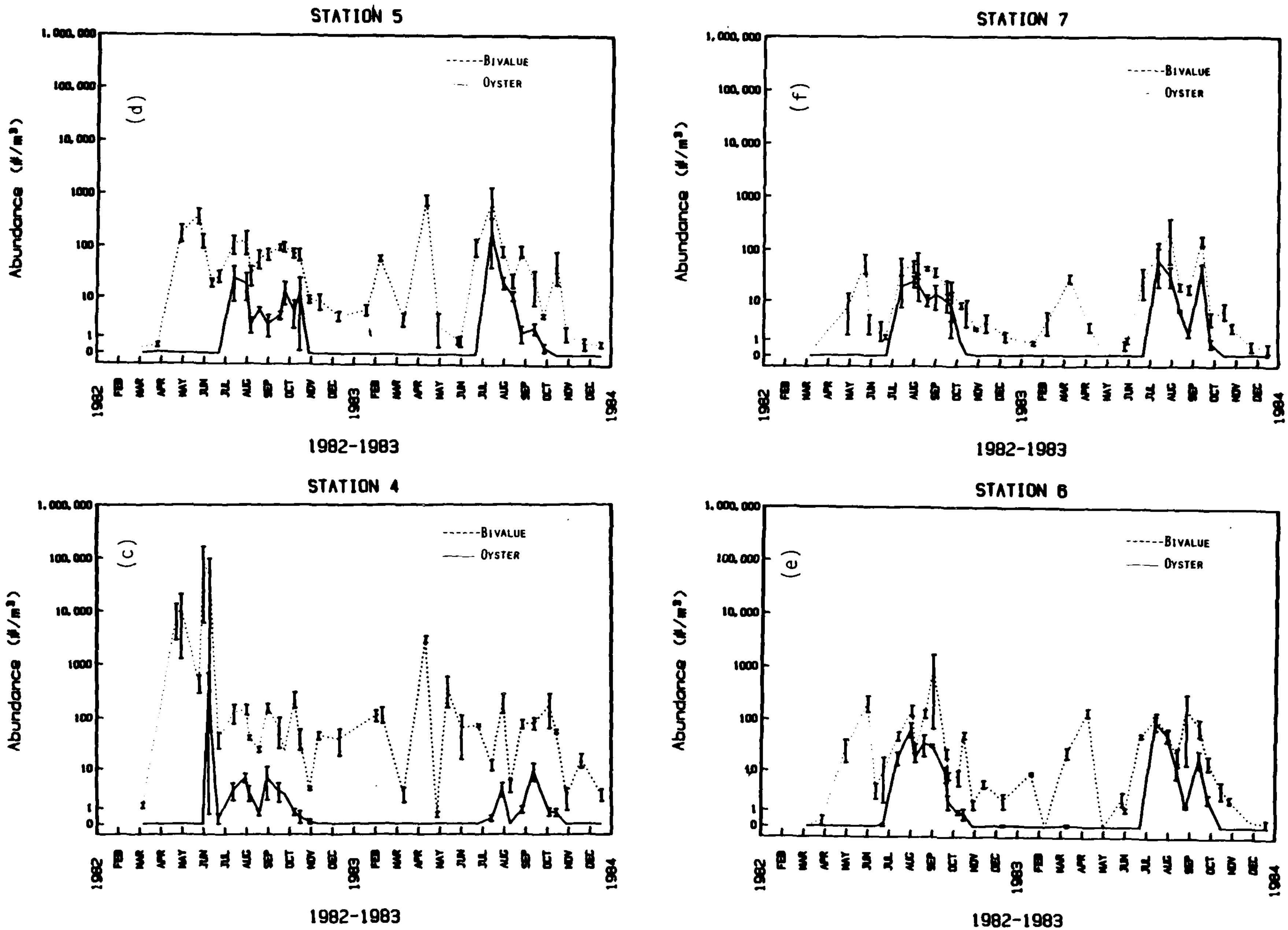

6
(j)
Abundance (#/m³)
1000
100
10
1
0
1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
1982-1983



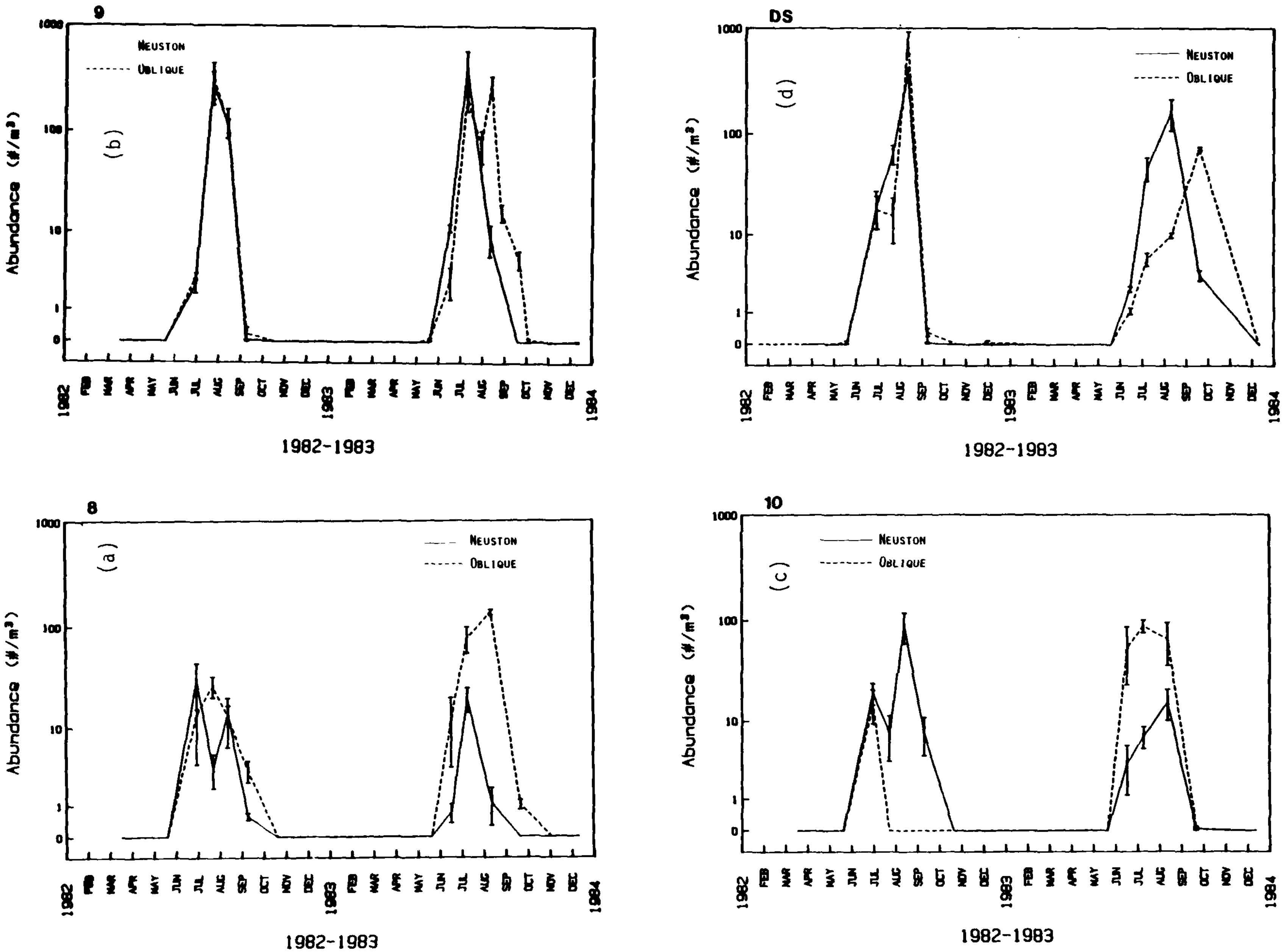
STATION 3
Abundance (#/m³)
1,000,000
100,000
10,000
1000
100
10
1
0
(b)
Bivalue
Oyster
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1984
1982-1983

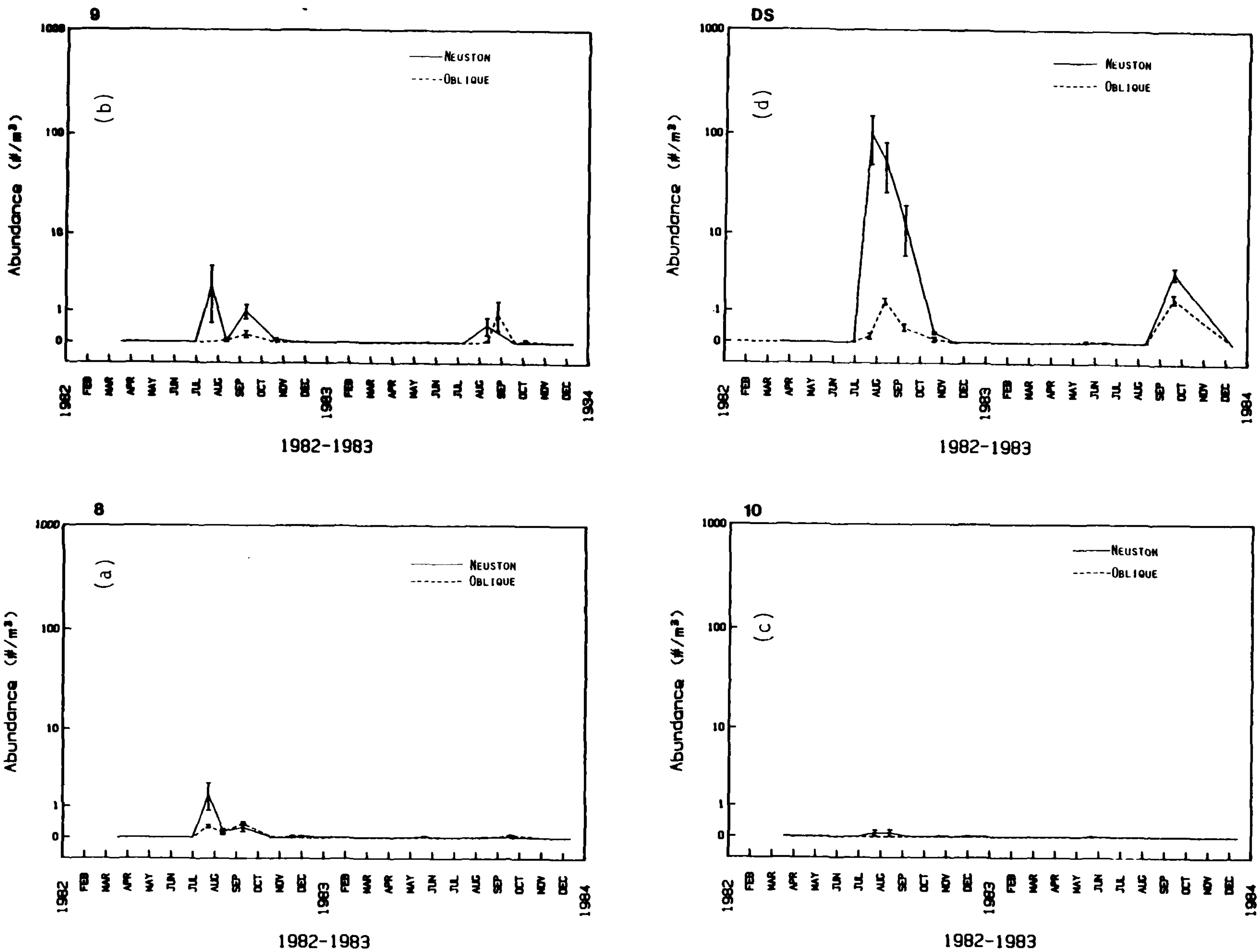


STATION 2
Abundance (#/m³)
100,000
10,000
1000
100
10
1
0
(a)
Bivalue
Oyster
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1984
1982-1983

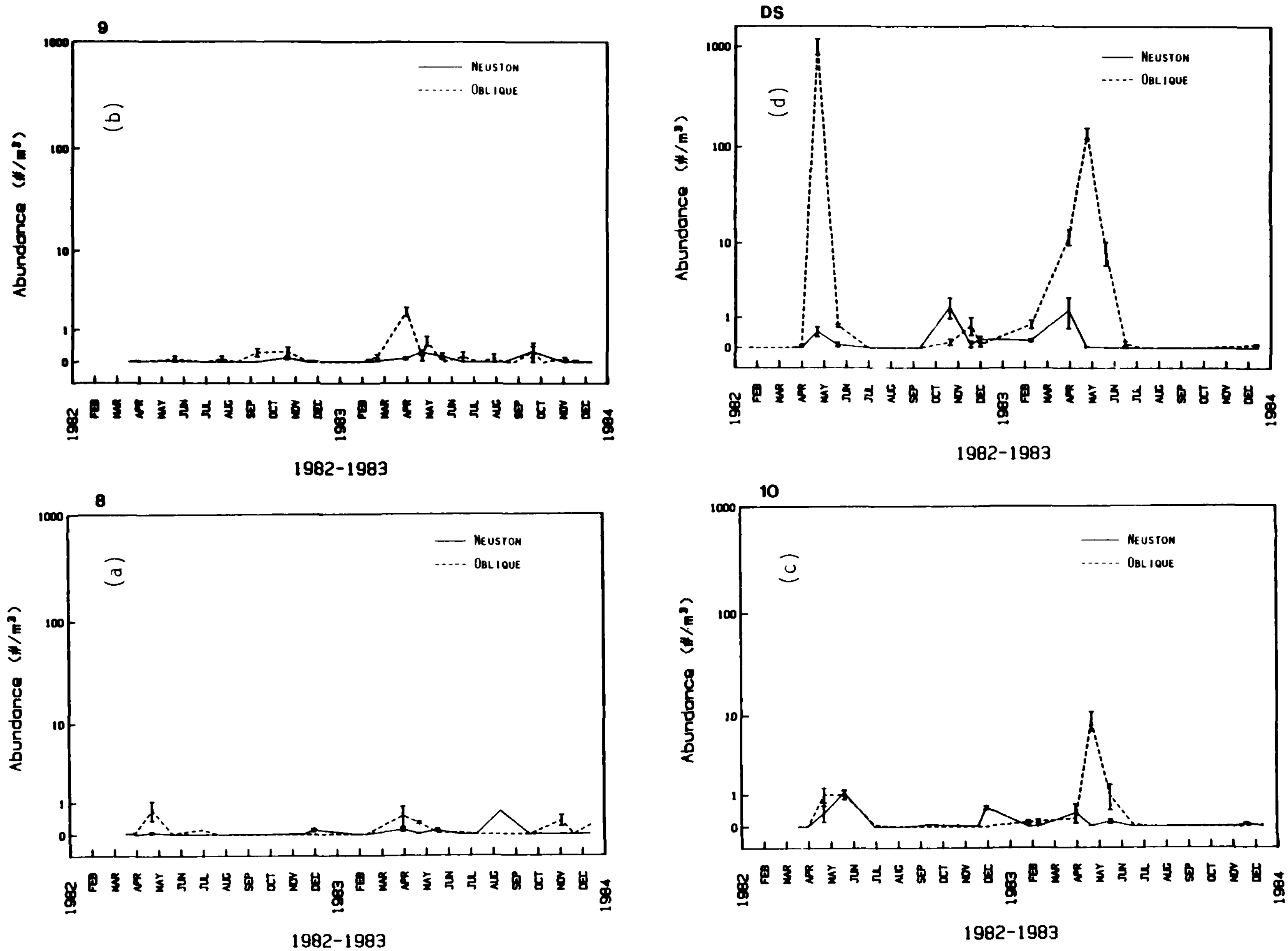


STATION 5
(d)
-----BIVALUE
OYSTER
Abundance (#/m³)
1,000,000
100,000
10,000
1000
100
10
1
0
1982 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1983 FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC 1984
1982-1983
STATION 7
(f)
-----BIVALUE
OYSTER
Abundance (#/m³)
1982-1983
STATION 4
(c)
-----BIVALUE
OYSTER
Abundance (#/m³)
1982-1983
STATION 6
(e)
-----BIVALUE
OYSTER
Abundance (#/m³)
1982-1983


9
(b)
NEUSTON
OBLIQUE
DS
(d)
NEUSTON
OBLIQUE
8
(a)
NEUSTON
OBLIQUE
10
(c)
NEUSTON
OBLIQUE
Abundance (#/m³)
1000
100
10
1
0
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
1984
1982-1983



9
(b)
DS
(d)
8
(a)
10
(c)
Abundance (#/m³)
NEUSTON
OBLIQUE
1000
100
10
1
0
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
1984
1982-1983


9
(b)
DS
(d)
8
(a)
10
(c)
Neuston
Oblique
Abundance (#/m³)
1000
100
10
1
0
1982
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1983
1984
1982-1983

DISCUSSION

Periods of reproductive activity are often correlated with physical environmental factors. These parameters often include, but may not be limited to temperature, salinity, photoperiod, suitable food (Thorson, 1946) and favorable seasonal current patterns (Knudsen, 1960; Effort, 1970; Rimmer and Phillips, 1979). Among these seasonal temperature change is considered dominant (Kinne, 1970; Giese and Pearse, 1974).

Meroplankton typically reproduce during the warmer months in boreal and temperate waters. In Chesapeake Bay, spawning of blue crabs and oysters occurred during the summer months as expected. Provenzano et al. (1983) suggested a synchronized hatching of blue crab larvae (Stage I) with the tidal cycle, and associated vertical stratification. The majority of the Stage I zoea were collected in the neuston layer during ebb tides, particularly during the evening hours. The present study showed no definitive vertical stratification of early stage zoea in the neuston (300 u size class counts). The seaward transport of these early stage larvae and offshore development is indicated by the increased abundance of both zoea and megalopae at NDS some 27 km east of the Bay mouth. As a result, the early stage zoea must concentrate in the low salinity surface waters associated with the Bay plume and its offshore transport. Similar studies from Florida to North Carolina support the contention that larval development of

Callinectus sapidus larvae occurs offshore (Nichols and Kenney, 1963; Dudley and Judy, 1971; Smyth, 1980). There is a subsequent re-invasion of the estuary by the megalopae and juvenile stages. This re-invasion is believed to be made possible by the prevailing wind and surface current patterns present off the Bay mouth during the late summer months (Hester, 1983; Johnson *et al*., 1983). The megalopae concentrate in the neuston offshore, however, the mechanism for blue crab recruitment to the Bay is not clear. Their vertical distribution probably changes as the megalopae molt to the juvenile stage. The currents are towards the Bay in late summer and autumn, and may aid the invasion process.

The oyster larvae were most abundant from July through September at the stations located near the mouths of the James and Elizabeth Rivers. Although the abundance were highly variable by date, peaks occurred in July and August in 1982. A definite bimodal distribution was recorded the following year with a decline in mid-August and a second peak in early September. Although oyster larvae were found in the vicinity of the Bay mouth, their counts were too low to indicate any major seaward transport. The oyster larvae tended to remain endemic to the parent populations and the literature supports the upriver transport in many instances. There was a paucity of planktonic bivalves at the inner stations. This implies that oysters are more successful due to less competition in the highly variable euryhaline environment.

The rock crab believed to be boreal in origin inhabit the continental shelf and slope waters from Labrador to South Carolina (Rathbun, 1930; Squires, 1966; Williams, 1965; Nations, 1975).

The crab occurs in shallow waters at its northern range (Williams, 1965; Templeman, 1966) and is found in the deeper, colder offshore waters along the more southern extention (MacKay, 1943). Along the Mid-Atlantic Bight it may be found in the inlets and bays as an adult. The larvae are hatched offshore; however, zoea are reported nearshore. In Chesapeake Bay the larvae occur during the colder months (October to May) near the Bay mouth. Their lack of abundance in the neuston collections supports previous studies for a preference for the cooler bottom waters.

CONCLUSION

Peak abundance of blue crab larvae occurs in mid to late summer at the deeper channels of the Chesapeake Bay mouth and NDS stations. Although no vertical stratification was noticed for early stage larvae, a seaward migration is indicated. Larval development occurs offshore where megalopae concentrate in the neuston layer prior to re-invasion of the Bay.

Larval rock crabs were collected throughout the colder winter months at the Bay mouth and NDS stations. Although peak abundances occurred in May offshore, larvae were also collected in early fall. The larvae tended to remain in the higher salinity and cooler bottom waters, as did the later stage megalopae.

Oyster larvae tended to remain in the vicinity of the James and Elizabeth Rivers confluence and infrequently occurred seaward. Most larvae occurred in the plankton during July and August. In 1983, a bimodal distribution was observed with a second peak as late as September. Bivalve larvae were very abundant at the outer stations; however, declined sharply at the inner stations. Oysters comprised a significant proportion of the total bivalve larvae present at these inner stations.

ACKNOWLEDGEMENTS

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REFERENCES

Boicourt, W.C. 1973. The circulation of water on the continental shelf from Chesapeake Bay to Cape Hatteras. Ph.D. Thesis, The Johns Hopkins University, Baltimore, MD. 183 pp.

Boicourt, W.C. 1981. Circulation in the Chesapeake Bay entrance region: Estuary-Shelf Interaction. In: Chesapeake Bay Plume Study (Eds: J.W. Campbell and J.P. Thomas) NASA Conference Publication 2188, NOAA/NEMP II 8L ABCDEFG 0042, U.S. Dept. of Commerce, pp. 61-78.

Carriker, M.R. 1951. Ecological observations on the distribution of oyster larvae in New Jersey estuaries. Ecol. Monogr. 21:19-38.

Chanley, P. and J.D. Andrews. 1971. Aids for identification of bivalve larvae of Virginia. Malaeologia 1161:45-119.

Connolly, C.J. 1923. The larval stages and megalopae of Cancer amoenus (Herbst.) Contrib. Can. Biol. (New Ser.) 1:335-352.

Costlow, J.D., and Bookhout, C.G. 1959. The larval development of Callinectes sapidus Rathbun reared in the laboratory. Biol. Bull. 116:373-396.

Dudley D.L. and M.H. Judy. 1971. Occurrence of larval, juvenile, and mature crabs in the vicinity of Beaufort Inlet, North Carolina. *U.S. Department of Commerce. NOAA Technical Report* NMFS SSRF-637, 10 pp.

Fish, C.J. 1925. Seasonal distribution of the plankton of the Woods Hole region. Bull. U.S. Bur. Fish., 41:1-91.

Giese, A.C. and J.S. Pearse. 1974. Introduction: General principles. In: A.C. Giese and J.S. Pearse, eds. Reproduction of marine invertebrates. Academic Press, New York. 49 pp.

Goy, J.W. 1976. Seasonal distribution and the retention of some decapod crustacean larvae within the Chesapeake Bay, Virginia. M.S. Thesis, Old Dominion University, Norfolk, VA. 334 pp.

Hester, B.S. 1983. A model of the population dynamics of the blue crab in Chesapeake Bay. Technical Report No. 83-6, Old Dominion University Research Foundation, Norfolk, VA. 116 pp.

Johnson, D.F. 1982. A comparison of recruitment strategies among brachyuran crustecean megalopae of the York River, Lower Chesapeake Bay and adjacent shelf waters. Ph.D. Dissertation, Old Dominion University, Norfolk, VA. 97 pp.

Johnson, D.R., B.S. Hester and J.R. McConaugha. 1983. Studies of a wind mechanism influencing the recruitment of blue crabs in the Middle Atlantic Bight. Technical Report No. 83-5, Old Dominion University Research Foundation, Norfolk, VA. 52 pp.

Johnson, R.E. 1976. Circulation study near Cape Henry, Virginia, using Lagrangian Techniques. Institute of Oceanography Tech. Rept. No. 21, Old Dominion University, Norfolk, VA. 80 pp.

Krouse, J.S. 1972. Some life history aspects of the rock crab, Cancer irroratus, in the Gulf of Maine. J. Fish. Res. Bd. Canada 29:1479-1482.

MacKay, D.C.G. 1943. Temperature and the world distribution of crabs of the genus Cancer. Ecology 24:113-115.

McConaugha, J.R., Provenzano, A.J. 1980. Distribution and migration of blue crab larvae in the lower Chesapeake Bay USA and adjacent coastal waters: Am. Zool. 20(40):888.

Musick, J.A., and J.D. McEachran. 1972. Autumn and winter occurrence of decapod crustaceans in Chesapeake Bight, USA Crustaceana 33:190-200.

Nations, J.D. 1975. The genus Cancer (Crustacea: Brachyura): Systematics, biogeography and fossil record. Nat. Hist. Mus. Los Ang. Cty., Sci. Bull. 23:1-104.

Nelson, J. 1911. Report of the biologist. Rept. Biol. Dept. N.J. Agr. Coll. Exp. Sta. for 1910:183-218.

Nichols, P.R. and P.M. Kiney. 1963. Crab larvae (Callinectes) in plankton collections from M/V Theodore N. Gill, South Atlantic Coast of the United States, 1953-54. U.S. Fish and Wildlife Service SSRF No. 448. 1-14 pp.

Provenzano, A.J., J.R. McConaugha, K.B. Philips, D.F. Johnson, J. Clark. 1983. Vertical distribution of first stage larvae of the blue crab, Callinectes sapidus, at the mouth of the Chesapeake Bay: Estuarine Coastal and Shelf Science, 16: 489-499 pp.

Rathbun, J.J. 1930. The cancroid crabs of American of the families Euryalidae, Portunidae, Atelecyclidae, Cancridae and Xanthidae. U.S. Natl. Mus. Bull. 152, 609 pp.

Sandifer, P.A. 1972. Morphology and ecology of Chesapeake Bay decapod crustacean larvae. Ph.D. Disertation, Univ. of Virginia (unpublished). 532 pp.

Sandifer, P.A. 1975. The role of pelagic larvae in recruitment to populations of adult decapod crustaceans in the York River estuary and adjacent lower Chesapeake Bay, Virginia. Estuarine and Coastal Marine Science 3, 269-279.

Sastry, A.N. 1970. Culture of brachyaran crab larvae using a re-circulating sea water system in the laboratory. Helgel. Wiss. Meeresunters 20:406-416.

Sastry, A.N. 1971. Culture of brachyaran larvae under controlled conditions. Proc. Joint Oceanogr. Assembly (Tokyo), VIII, Abstr. Contrib. Pap.:475-477.

Smyth, P.O. 1980. Callinectes (Decapode: Portunnidue) larvae in the middle Atlantic Bight, 1975-1977. Fishery Bulletin, 78: 251-265.

Squires, H.J. 1966. Distribution of decapod Crustacea in the northwest Atlantic. American Geographical Society, Serial Atlas of the Marine Environment, Folio 12.

Templeman, W. 1966. Marine resources of Newfoundland. Fish. Res. Board Can., Bull. 154, 170 pp.

Thorson, G. 1946. Reproduction and larval development of Danish marine bottom invertebrates, with special reference to the planktonic larvae in the sound (Oresund). (With a section on lamellibranch larvae by C.B. Jorgensen). Medd. Komm. Danm. Fiskeri-og Havunders., Serie: Plankton 4:1-523.

Van Engle, W.A. 1958. The blue crab and its fishery in Chesapeake Bay. Part I. Reproduction, early development, growth and migration. Comm. Fish. Rev. 20:6-17.

Virginia Marine Resources Commission. Personal Communication. 1984.

Williams, A.B. 1965. Marine decapod crustaceans of the Carolinas Fishery Bulletin 65:1-298.

Wood, L. and W.J. Hargis. 1971. Transport of bivalve larvae in a tidal estuary. In: Fourth European Marine Biology Symposium (Ed: D.J. Crisp) Cambridge Univ. Press: 29-44.

APPENDIX

ABUNDANCE TABLES BY STATION

****

MOLLUSCS
SUMMARY OF TOWS AT STATION 1
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	All Bivalves	Oysters
16FEB82	442.21 (275.02)	0.00 (.)
09MAR82	7.03 (3.43)	0.00 (.)
03APR82	106.61 (61.45)	0.01 (0.01)
30APR82	1034.20 (370.40)	0.00 (.)
24MAY82	989.90 (387.28)	0.00 (.)
30MAY82	52639.88 (52419.00)	0.00 (.)
08JUN82	338.24 (138.17)	0.00 (.)
21JUN82	1729.09 (406.77)	0.00 (.)
12JUL82	165.87 (28.15)	1.44 (0.77)
30JUL82	948.33 (313.88)	1.10 (0.70)
04AUG82	57.52 (28.60)	0.58 (0.51)
18AUG82	49.45 (5.12)	1.69 (0.36)
30AUG82	128.76 (36.84)	0.08 (0.08)
16SEP82	220.55 (78.32)	0.58 (0.38)
24SEP82	75.96 (9.37)	1.04 (0.36)
07OCT82	59.23 (5.48)	2.78 (0.97)
15OCT82	166.86 (38.47)	0.08 (0.08)
29OCT82	151.08 (15.06)	0.00 (.)
11NOV82	276.65 (79.11)	0.00 (.)
24NOV82	275.99 (82.08)	0.00 (.)
10DEC82	2923.71 (2493.08)	0.00 (.)
21DEC82	799.07 (237.43)	0.00 (.)
24JAN83	160.85 (42.89)	0.00 (.)
31JAN83	310.35 (119.49)	0.00 (.)
09FEB83	217.75 (79.60)	0.00 (.)
21FEB83	1412.91 (288.70)	0.00 (.)
10MAR83	162.52 (44.35)	0.00 (.)
28MAR83	54.15 (12.52)	0.00 (.)
11APR83	207.97 (31.91)	0.00 (.)
27APR83	16.16 (2.55)	0.00 (.)
11MAY83	330.36 (60.87)	0.00 (.)
31MAY83	730.00 (110.53)	0.00 (.)
24JUN83	161.17 (66.86)	0.10 (0.10)
13JUL83	647.55 (54.24)	0.00 (.)
28JUL83	256.83 (109.88)	0.00 (.)
09AUG83	73.43 (42.40)	0.00 (.)
26AUG83	163.42 (81.19)	0.00 (.)
12SEP83	176.37 (50.30)	0.68 (0.54)
03OCT83	294.84 (92.92)	5.60 (2.54)
13OCT83	183.80 (121.13)	0.67 (0.14)
11DEC83	84.41 (24.44)	0.00 (.)

****

****

MOLLUSCS
SUMMARY OF TOWS AT STATION 2
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	All Bivalves	Oysters
16FEB82	193.53 (61.44)	0.00 (.)
09MAR82	4.52 (2.21)	0.00 (.)
22APR82	46904.54 (27308.31)	0.00 (.)
29APR82	685.77 (399.79)	0.00 (.)
24MAY82	185.34 (74.11)	0.00 (.)
30MAY82	1856.09 (1510.27)	0.00 (.)
08JUN82	266.09 (73.46)	0.00 (.)
21JUN82	157.55 (41.53)	0.00 (.)
12JUL82	1402.51 (1266.39)	0.95 (0.47)
30JUL82	33.61 (15.84)	3.04 (1.86)
04AUG82	122.21 (97.53)	3.22 (2.58)
18AUG82	29.43 (16.40)	2.02 (0.97)
30AUG82	28.75 (11.01)	3.45 (2.59)
16SEP82	160.31 (74.26)	4.16 (3.36)
24SEP82	59.36 (4.51)	5.57 (1.95)
07OCT82	94.19 (32.28)	0.33 (0.19)
15OCT82	43.86 (6.19)	0.56 (0.34)
29OCT82	10.62 (4.41)	0.00 (.)
11NOV82	109.79 (34.86)	0.00 (.)
24NOV82	105.11 (57.40)	0.00 (.)
10DEC82	50.41 (21.42)	0.00 (.)
22DEC82	55.30 (11.02)	0.00 (.)
31JAN83	1784.21 (251.93)	0.00 (.)
09FEB83	151.33 (56.49)	0.00 (.)
21FEB83	31.15 (4.70)	0.00 (.)
10MAR83	391.38 (139.19)	0.00 (.)
28MAR83	13.44 (6.23)	0.00 (.)
11APR83	381.12 (128.50)	0.00 (.)
27APR83	7.81 (3.86)	0.00 (.)
11MAY83	1974.74 (574.70)	0.00 (.)
31MAY83	379.97 (80.40)	0.00 (.)
24JUN83	985.64 (451.08)	0.11 (0.11)
13JUL83	742.65 (262.14)	0.00 (.)
28JUL83	574.55 (355.72)	2.12 (1.55)
09AUG83	85.62 (14.47)	0.00 (.)
26AUG83	65.97 (23.74)	0.12 (0.07)
12SEP83	1046.04 (171.68)	1.22 (0.08)
03OCT83	180.99 (48.87)	1.12 (0.25)
13OCT83	35.69 (17.90)	0.31 (0.16)
28OCT83	14.05 (3.70)	0.00 (.)
18NOV83	0.16 (0.06)	0.00 (.)
02DEC83	3.16 (0.64)	0.00 (.)

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MOLLUSCS
SUMMARY OF TOWS AT STATION 3
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	All Bivalves	Oysters
16FEB82	281.73 (125.99)	0.00 (.)
09MAR82	0.93 (0.11)	0.00 (.)
22APR82	90617.47 (26261.10)	0.00 (.)
29APR82	107478.03 (95958.41)	0.00 (.)
24MAY82	311.67 (85.98)	0.00 (.)
30MAY82	1550.78 (766.17)	0.00 (.)
08JUN82	228.23 (107.89)	0.03 (0.03)
21JUN82	24.67 (12.98)	0.00 (.)
12JUL82	123.27 (49.19)	0.16 (0.16)
30JUL82	14.97 (5.21)	0.66 (0.62)
04AUG82	17.05 (3.16)	0.00 (.)
18AUG82	25.37 (8.08)	2.39 (1.29)
30AUG82	36.63 (5.78)	2.74 (0.84)
16SEP82	170.88 (89.62)	1.67 (0.65)
24SEP82	18.36 (3.28)	1.07 (0.09)
07OCT82	99.99 (8.91)	1.31 (0.18)
15OCT82	26.76 (7.02)	0.00 (.)
29OCT82	22.53 (3.74)	0.00 (.)
11NOV82	178.29 (70.00)	0.00 (.)
24NOV82	177.02 (62.14)	0.00 (.)
10DEC82	229.28 (148.19)	0.00 (.)
22DEC82	35.73 (1.81)	0.00 (.)
31JAN83	389.56 (67.86)	0.00 (.)
09FEB83	203.48 (150.99)	0.00 (.)
21FEB83	732.32 (473.53)	0.00 (.)
10MAR83	31.96 (11.99)	0.00 (.)
28MAR83	39.85 (7.65)	0.00 (.)
11APR83	449.22 (198.90)	0.00 (.)
27APR83	10.83 (5.86)	0.00 (.)
11MAY83	1772.92 (338.45)	0.00 (.)
31MAY83	1047.53 (399.19)	0.00 (.)
24JUN83	184.86 (34.57)	0.76 (0.76)
13JUL83	8819.65 (4505.67)	0.00 (.)
28JUL83	132.40 (38.49)	0.55 (0.55)
09AUG83	46.87 (18.80)	0.33 (0.22)
26AUG83	160.75 (50.55)	0.21 (0.09)
12SEP83	461.66 (128.00)	0.32 (0.19)
03OCT83	24.94 (8.39)	0.23 (0.23)
13OCT83	117.37 (49.22)	0.39 (0.23)
28OCT83	6.02 (1.37)	0.00 (.)
18NOV83	6.58 (2.35)	0.00 (.)
02DEC83	9.60 (4.03)	0.00 (.)

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MOLLUSCS
SUMMARY OF TOWS AT STATION 4
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	All Bivalves	Oysters
04MAR82	0.53 (0.67)	-0.00 (0.00)
22APR82	8169.13 (5284.92)	0.00 (.)
29APR82	10941.57 (9681.72)	0.00 (.)
24MAY82	450.17 (161.79)	0.00 (.)
30MAY82	85232.82 (79260.74)	0.00 (.)
08JUN82	19817.98 (19763.09)	347.23 (346.70)
21JUN82	37.77 (13.17)	0.27 (0.27)
12JUL82	125.15 (50.19)	3.23 (1.50)
30JUL82	143.21 (31.37)	6.28 (1.46)
04AUG82	40.53 (3.95)	2.88 (1.23)
18AUG82	24.07 (2.88)	0.63 (0.21)
30AUG82	154.62 (28.71)	6.24 (4.46)
16SEP82	62.61 (37.34)	3.20 (1.63)
24SEP82	21.74 (0.47)	2.67 (0.13)
07OCT82	225.16 (73.97)	0.64 (0.22)
15OCT82	39.93 (17.33)	0.35 (0.35)
29OCT82	3.60 (0.34)	0.11 (0.11)
11NOV82	44.17 (7.41)	0.00 (.)
10DEC82	38.42 (20.54)	0.00 (.)
31JAN83	109.34 (27.02)	0.00 (.)
09FEB83	116.12 (38.79)	0.00 (.)
10MAR83	2.60 (1.10)	0.00 (.)
11APR83	2968.54 (423.40)	0.00 (.)
27APR83	0.49 (0.17)	0.00 (.)
11MAY83	363.11 (210.63)	0.00 (.)
31MAY83	62.24 (47.13)	0.00 (.)
24JUN83	69.21 (4.58)	0.00 (.)
13JUL83	11.66 (2.81)	0.25 (0.16)
29JUL83	196.80 (77.60)	3.38 (1.27)
09AUG83	4.17 (1.36)	0.00 (.)
26AUG83	74.65 (14.46)	0.84 (0.26)
12SEP83	77.67 (19.85)	8.83 (3.59)
03OCT83	169.69 (108.24)	0.66 (0.27)
13OCT83	52.69 (4.17)	0.61 (0.26)
28OCT83	2.24 (1.44)	0.00 (.)
18NOV83	14.56 (4.56)	0.00 (.)
16DEC83	2.53 (0.87)	0.00 (.)

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MOLLUSCS
SUMMARY OF TOWS AT STATION 5
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	All Bivalves		Oysters	
04MAR82	0.29	(0.03)	0.00	(.)
26MAR82	0.42	(0.15)	0.04	(0.02)
29APR82	187.56	(69.41)	0.00	(.)
23MAY82	391.25	(129.37)	0.00	(.)
29MAY82	129.24	(38.62)	0.00	(.)
11JUN82	20.02	(3.69)	0.00	(.)
22JUN82	26.75	(6.89)	0.00	(.)
12JUL82	114.38	(44.77)	24.87	(16.53)
30JUL82	130.10	(62.58)	19.45	(10.94)
06AUG82	28.96	(12.06)	2.42	(1.10)
18AUG82	59.96	(22.92)	5.51	(0.70)
31AUG82	71.63	(17.63)	2.62	(1.59)
17SEP82	95.03	(13.03)	4.06	(0.86)
23SEP82	98.52	(21.54)	13.94	(6.81)
06OCT82	74.49	(15.37)	5.41	(3.45)
14OCT82	70.46	(17.86)	12.61	(12.49)
28OCT82	9.16	(1.69)	0.00	(.)
12NOV82	8.63	(3.17)	0.00	(.)
09DEC82	4.00	(1.00)	0.00	(.)
18JAN83	5.55	(1.46)	0.00	(.)
07FEB83	60.60	(7.57)	0.00	(.)
10MAR83	3.46	(1.21)	0.00	(.)
11APR83	792.73	(175.45)	0.00	(.)
29APR83	2.51	(2.18)	0.00	(.)
26MAY83	0.80	(0.28)	0.00	(.)
30MAY83	0.78	(0.40)	0.00	(.)
21JUN83	104.19	(38.53)	0.00	(.)
12JUL83	731.91	(616.28)	205.98	(164.72)
29JUL83	83.56	(19.30)	21.51	(5.61)
12AUG83	23.15	(6.77)	11.69	(2.41)
25AUG83	84.19	(20.69)	1.57	(0.89)
13SEP83	21.26	(14.10)	2.16	(0.75)
26SEP83	4.20	(0.45)	0.39	(0.26)
14OCT83	50.65	(31.53)	0.00	(.)
28OCT83	1.46	(0.73)	0.00	(.)
23NOV83	0.59	(0.39)	0.00	(.)
16DEC83	0.56	(0.19)	0.00	(.)

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MOLLUSCS
SUMMARY OF TOWS AT STATION 6
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

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DATE	All Bivalves		Oysters	
05MAR82	0.06	(0.03)	0.00	(.)
26MAR82	0.30	(0.27)	0.00	(.)
29APR82	27.92	(13.38)	0.00	(.)
29MAY82	207.55	(69.91)	0.00	(.)
11JUN82	3.77	(1.50)	0.00	(.)
22JUN82	10.26	(8.45)	0.07	(0.07)
12JUL82	48.52	(9.24)	17.78	(5.24)
31JUL82	150.27	(34.56)	65.05	(20.18)
06AUG82	28.73	(5.64)	18.66	(3.86)
19AUG82	129.03	(22.43)	34.75	(15.63)
31AUG82	899.54	(831.42)	31.45	(2.12)
20SEP82	22.52	(4.84)	8.74	(3.13)
23SEP82	7.91	(1.42)	1.93	(0.86)
06OCT82	7.38	(2.66)	0.82	(0.16)
14OCT82	50.44	(7.68)	0.72	(0.41)
28OCT82	1.60	(0.50)	0.02	(0.01)
12NOV82	5.23	(0.99)	0.01	(0.01)
09DEC82	2.14	(0.97)	0.05	(0.05)
18JAN83	8.82	(0.58)	0.00	(.)
07FEB83	0.00	(.)	0.00	(.)
08MAR83	24.05	(5.78)	0.06	(0.06)
06APR83	141.54	(25.84)	0.00	(.)
29APR83	0.00	(.)	0.00	(.)
26MAY83	2.47	(1.00)	0.00	(.)
30MAY83	1.08	(0.20)	0.00	(.)
21JUN83	51.90	(4.29)	0.00	(.)
12JUL83	113.49	(27.68)	93.57	(27.98)
29JUL83	56.42	(14.43)	53.27	(14.51)
12AUG83	21.31	(8.28)	11.22	(4.08)
25AUG83	162.91	(149.21)	1.47	(0.12)
13SEP83	78.01	(28.60)	18.93	(7.22)
26SEP83	15.74	(4.95)	2.46	(0.64)
14OCT83	4.22	(1.84)	0.00	(.)
26OCT83	2.37	(0.48)	0.00	(.)
23NOV83	0.33	(0.04)	0.00	(.)
16DEC83	0.20	(0.20)	0.00	(.)

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MOLLUSCS
SUMMARY OF TOWS AT STATION 7
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	All Bivalves		Oysters	
05MAR82	0.12 (	0.02)	0.00 (	.)
29APR82	7.60 (	6.15)	0.02 (	0.02)
23MAY82	60.74 (	21.89)	0.00 (	.)
29MAY82	3.55 (	1.48)	0.00 (	.)
15JUN82	2.10 (	1.25)	0.00 (	.)
22JUN82	1.21 (	0.21)	0.00 (	.)
13JUL82	43.03 (	23.43)	19.17 (	12.05)
31JUL82	46.64 (	12.02)	23.66 (	5.86)
06AUG82	55.33 (	28.88)	21.10 (	11.51)
19AUG82	42.25 (	3.51)	10.13 (	2.62)
31AUG82	36.22 (	7.04)	13.15 (	6.72)
17SEP82	17.45 (	6.92)	9.55 (	3.90)
23SEP82	13.54 (	9.97)	7.99 (	6.81)
06OCT82	7.94 (	1.17)	0.75 (	0.07)
14OCT82	6.27 (	3.80)	0.06 (	0.04)
28OCT82	2.17 (	0.18)	0.00 (	.)
12NOV82	2.99 (	1.83)	0.00 (	.)
09DEC82	1.31 (	0.49)	0.00 (	.)
18JAN83	0.70 (	0.15)	0.00 (	.)
07FEB83	3.52 (	2.08)	0.00 (	.)
08MAR83	28.01 (	5.35)	0.00 (	.)
06APR83	2.48 (	0.70)	0.00 (	.)
26MAY83	0.57 (	0.30)	0.00 (	.)
30MAY83	0.94 (	0.26)	0.00 (	.)
21JUN83	26.61 (	15.90)	0.00 (	.)
12JUL83	85.68 (	50.13)	62.25 (	43.41)
29JUL83	216.47 (	163.09)	31.81 (	13.45)
12AUG83	19.05 (	3.08)	6.18 (	0.41)
25AUG83	17.08 (	3.25)	1.67 (	0.44)
13SEP83	148.85 (	29.32)	38.85 (	13.48)
26SEP83	4.19 (	1.45)	0.70 (	0.33)
14OCT83	6.34 (	2.44)	0.00 (	.)
26OCT83	2.40 (	0.68)	0.00 (	.)
23NOV83	0.50 (	0.32)	0.00 (	.)
16DEC83	0.39 (	0.29)	0.00 (	.)

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MOLLUSCS
SUMMARY OF TOWS AT STATION 8
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	All Bivalves	Oysters
20OCT82	0.00 (.)	0.00 (.)
18NOV82	614.32 (179.51)	0.00 (.)
30NOV82	229.65 (85.84)	0.00 (.)
26JAN83	55.17 (12.06)	0.00 (.)
09FEB83	43.14 (24.92)	0.00 (.)
30MAR83	138.28 (26.65)	0.00 (.)
21APR83	60.67 (23.49)	0.00 (.)
19MAY83	736.77 (180.78)	0.00 (.)
16JUN83	574.04 (54.36)	0.00 (.)
08JUL83	3558.09 (2069.69)	0.00 (.)
11AUG83	121.43 (14.40)	0.00 (.)
20SEP83	75.55 (13.52)	1.89 (0.40)
02NOV83	182.40 (60.53)	0.00 (.)
23NOV83	20.41 (7.28)	0.00 (.)
10DEC83	197.02 (70.82)	0.00 (.)

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MOLLUSCS
SUMMARY OF TOWS AT STATION 9
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	All Bivalves	Oysters
30JUN82	268.48 (248.46)	0.00 (.)
22JUL82	0.00 (.)	0.00 (.)
12AUG82	0.00 (.)	0.00 (.)
09SEP82	0.00 (.)	0.00 (.)
20OCT82	0.04 (0.04)	0.00 (.)
18NOV82	429.93 (105.85)	0.00 (.)
24NOV82	71.36 (4.92)	0.00 (.)
30NOV82	143.66 (32.27)	0.00 (.)
22DEC82	75.00 (10.25)	0.00 (.)
26JAN83	32.53 (2.74)	0.00 (.)
21FEB83	198.31 (44.39)	0.00 (.)
30MAR83	102.71 (30.13)	0.00 (.)
21APR83	28.09 (15.97)	0.00 (.)
27APR83	27.97 (22.66)	0.00 (.)
19MAY83	4513.06 (391.14)	0.00 (.)
16JUN83	65.38 (11.67)	0.00 (.)
08JUL83	1084.64 (477.75)	0.00 (.)
28JUL83	1483.93 (233.47)	1.38 (1.38)
11AUG83	153.67 (8.42)	0.00 (.)
26AUG83	1156.85 (314.99)	3.09 (1.22)
20SEP83	50.00 (10.33)	5.06 (1.65)
03OCT83	81.17 (9.67)	0.07 (0.07)
02NOV83	45.80 (14.71)	0.00 (.)
18NOV83	56.41 (20.93)	0.00 (.)
23NOV83	25.80 (6.39)	0.00 (.)
10DEC83	6.02 (2.85)	0.00 (.)

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MOLLUSCS
SUMMARY OF TOWS AT STATION 10
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	All Bivalves		Oysters	
20OCT82	0.00	(.)	0.00	(.)
18NOV82	478.09	(120.24)	0.00	(.)
30NOV82	163.58	(54.99)	0.00	(.)
26JAN83	12.66	(5.11)	0.00	(.)
30MAR83	36.64	(10.61)	0.00	(.)
21APR83	216.76	(23.72)	0.00	(.)
19MAY83	10019.61	(3198.93)	0.00	(.)
16JUN83	82.93	(38.28)	0.00	(.)
08JUL83	308.53	(122.58)	0.00	(.)
11AUG83	118.17	(24.39)	0.00	(.)
20SEP83	57.94	(7.12)	2.74	(0.75)
02NOV83	25.66	(5.21)	0.00	(.)
11DEC83	101.34	(22.50)	0.00	(.)

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MOLLUSCS
SUMMARY OF TOWS AT STATION DS
MEAN OF 4 153 MICRON OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	All Bivalves	Oysters
19OCT82	0.00 (.)	0.00 (.)
17NOV82	14991.65 (5390.91)	0.00 (.)
30NOV82	4206.17 (1302.30)	0.00 (.)
08FEB83	186.42 (53.95)	0.00 (.)
29MAR83	151.05 (31.77)	0.00 (.)
23APR83	2.98 (0.94)	0.00 (.)
18MAY83	17.89 (7.16)	0.00 (.)
14JUN83	1342.67 (322.10)	0.00 (.)
07JUL83	5120.14 (3039.71)	0.00 (.)
10AUG83	388.66 (211.56)	0.00 (.)
19SEP83	17.85 (1.09)	0.00 (.)
10DEC83	86.13 (22.25)	0.00 (.)

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COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 1
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irror atus zoea	Cancer irror atus Megalop
03APR82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
30APR82	0.00 (.)	0.00 (0.00)	14.02 (2.13)	0.00 (.)
30MAY82	0.00 (.)	1.02 (0.40)	0.01 (0.01)	0.00 (0.00)
08JUN82	0.00 (0.00)	16.61 (2.64)	0.02 (0.02)	0.00 (0.00)
21JUN82	0.00 (.)	1.37 (0.66)	0.00 (.)	0.00 (.)
12JUL82	0.00 (.)	39.64 (15.43)	0.00 (.)	0.00 (.)
30JUL82	0.10 (0.03)	16.07 (3.89)	0.00 (.)	0.00 (.)
04AUG82	0.07 (0.05)	127.90 (40.44)	0.00 (.)	0.00 (.)
18AUG82	1.69 (0.39)	151.52 (27.46)	0.20 (0.07)	0.00 (.)
30AUG82	0.48 (0.16)	181.25 (72.98)	0.07 (0.07)	0.03 (0.03)
16SEP82	0.09 (0.05)	2.55 (1.49)	0.30 (0.24)	0.00 (.)
24SEP82	0.00 (.)	6.39 (3.63)	5.05 (2.98)	0.00 (.)
07OCT82	0.00 (.)	0.00 (.)	0.17 (0.05)	0.00 (.)
15OCT82	0.00 (.)	0.00 (.)	0.77 (0.36)	0.00 (.)
29OCT82	0.00 (.)	0.00 (.)	0.27 (0.04)	0.00 (.)
11NOV82	0.00 (.)	0.00 (.)	1.10 (0.24)	0.00 (.)
10DEC82	0.00 (.)	0.01 (0.01)	0.00 (.)	0.00 (.)
21DEC82	0.00 (.)	0.00 (.)	0.00 (0.00)	0.00 (.)
31JAN83	0.00 (.)	0.01 (0.01)	0.01 (0.01)	0.00 (.)
21FEB83	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
10MAR83	0.00 (.)	0.00 (.)	0.46 (0.07)	0.00 (.)
28MAR83	0.00 (.)	0.00 (.)	1.15 (0.25)	0.00 (.)
11APR83	0.00 (.)	0.00 (.)	59.04 (9.61)	0.00 (.)
27APR83	0.00 (.)	0.00 (.)	26.99 (4.11)	0.00 (.)
11MAY83	0.00 (.)	0.00 (.)	5.29 (0.23)	0.00 (.)
31MAY83	0.01 (0.00)	0.00 (.)	1.15 (0.21)	0.00 (.)
24JUN83	0.00 (.)	2.65 (1.11)	0.00 (.)	0.00 (.)
13JUL83	0.00 (.)	139.76 (60.04)	0.00 (.)	0.00 (.)
28JUL83	0.00 (.)	29.43 (8.79)	0.00 (.)	0.00 (.)
09AUG83	0.06 (0.03)	22.77 (9.75)	0.01 (0.01)	0.00 (.)
26AUG83	0.14 (0.14)	499.26 (30.00)	0.00 (.)	0.00 (.)
12SEP83	0.04 (0.04)	12.63 (4.38)	0.00 (.)	0.00 (.)
03OCT83	0.01 (0.01)	0.00 (.)	0.45 (0.16)	0.00 (.)
13OCT83	0.10 (0.04)	0.00 (.)	0.00 (.)	0.00 (.)
01NOV83	0.00 (.)	0.00 (.)	0.15 (0.12)	0.00 (.)
19NOV83	0.00 (.)	0.00 (.)	0.12 (0.04)	0.00 (0.00)
11DEC83	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)

COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 2
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irroratus zoea	Cancer irroratus Megalop
09MAR82	0.00 (.)	0.00 (.)	0.07 (0.06)	0.00 (.)
22APR82	0.00 (.)	0.00 (.)	0.66 (0.09)	0.00 (.)
29APR82	0.00 (.)	0.00 (.)	96.72 (47.19)	0.00 (.)
24MAY82	0.00 (.)	0.47 (0.10)	0.00 (.)	0.00 (.)
30MAY82	0.00 (.)	0.39 (0.24)	0.00 (.)	0.00 (.)
08JUN82	0.00 (.)	8.15 (2.25)	0.00 (.)	0.00 (.)
21JUN82	0.00 (.)	3.48 (1.38)	0.00 (.)	0.00 (.)
12JUL82	0.03 (0.03)	27.24 (10.01)	0.00 (.)	0.00 (.)
30JUL82	0.06 (0.03)	88.69 (23.84)	0.00 (.)	0.00 (.)
04AUG82	0.02 (0.01)	236.64 (44.16)	1.92 (0.89)	0.01 (0.01)
18AUG82	0.00 (.)	5.03 (4.84)	1.47 (1.17)	0.00 (.)
30AUG82	0.01 (0.01)	1.37 (0.79)	1.24 (1.18)	0.00 (.)
16SEP82	0.03 (0.02)	0.66 (0.31)	0.00 (.)	0.00 (.)
24SEP82	0.06 (0.04)	0.23 (0.08)	0.53 (0.36)	0.00 (.)
07OCT82	0.03 (0.02)	0.00 (.)	5.91 (1.10)	0.00 (.)
15OCT82	0.00 (.)	0.00 (.)	0.27 (0.05)	0.04 (0.02)
29OCT82	0.00 (.)	0.00 (.)	0.79 (0.12)	0.00 (.)
11NOV82	0.00 (.)	0.00 (.)	0.79 (0.10)	0.07 (0.07)
10DEC82	0.00 (.)	0.00 (.)	0.02 (0.02)	0.00 (.)
22DEC82	0.00 (.)	0.00 (.)	0.06 (0.06)	0.00 (.)
31JAN83	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
09FEB83	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
10MAR83	0.00 (.)	0.00 (.)	0.08 (0.06)	0.00 (.)
28MAR83	0.01 (0.01)	0.00 (.)	0.16 (0.06)	0.00 (.)
11APR83	0.00 (.)	0.00 (.)	2.36 (0.35)	0.00 (.)
27APR83	0.00 (.)	0.00 (.)	0.10 (0.07)	0.00 (.)
11MAY83	0.00 (.)	0.00 (.)	0.91 (0.58)	0.00 (.)
31MAY83	0.00 (.)	0.00 (0.00)	0.77 (0.43)	0.00 (.)
24JUN83	0.00 (.)	2.42 (1.04)	0.00 (.)	0.00 (.)
13JUL83	0.00 (.)	9.63 (3.82)	0.00 (.)	0.00 (.)
28JUL83	0.00 (.)	167.84 (51.59)	0.02 (0.02)	0.00 (.)
09AUG83	0.02 (0.02)	30.98 (2.05)	0.00 (.)	0.00 (.)
26AUG83	0.12 (0.06)	16.25 (4.41)	0.00 (.)	0.00 (.)
12SEP83	0.29 (0.20)	0.01 (0.01)	0.13 (0.09)	0.00 (.)
28OCT83	0.00 (.)	0.00 (.)	0.21 (0.08)	0.00 (.)
18NOV83	0.00 (.)	0.01 (0.01)	0.00 (.)	0.00 (.)
02DEC83	0.00 (.)	0.04 (0.03)	0.00 (.)	0.00 (.)

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COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 3
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

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DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irroratus zoea	Cancer irroratus Megalop
22APR82	0.00 (.)	0.00 (.)	0.18 (0.07)	0.00 (.)
29APR82	0.00 (0.00)	0.00 (.)	41.38 (5.40)	0.00 (.)
24MAY82	0.00 (.)	0.67 (0.67)	0.07 (0.07)	0.00 (.)
30MAY82	0.00 (.)	0.40 (0.15)	0.00 (.)	0.00 (.)
08JUN82	0.00 (.)	0.47 (0.44)	0.00 (.)	0.00 (.)
21JUN82	0.00 (.)	0.90 (0.80)	0.00 (.)	0.00 (.)
12JUL82	0.00 (0.00)	2.80 (1.09)	0.00 (.)	0.00 (.)
30JUL82	0.03 (0.02)	74.57 (41.90)	0.00 (.)	0.00 (.)
18AUG82	1.03 (0.62)	63.92 (43.75)	0.00 (.)	0.01 (0.01)
30AUG82	1.36 (0.80)	4.83 (0.38)	0.00 (.)	0.00 (.)
16SEP82	0.07 (0.04)	0.30 (0.19)	0.43 (0.39)	0.00 (.)
24SEP82	0.00 (.)	0.14 (0.14)	0.00 (.)	0.00 (.)
07OCT82	0.07 (0.05)	0.00 (.)	0.65 (0.32)	0.00 (.)
15OCT82	0.00 (.)	0.04 (0.04)	0.22 (0.07)	0.00 (.)
11NOV82	0.00 (.)	0.00 (.)	0.42 (0.08)	0.00 (.)
10DEC82	0.00 (.)	0.00 (.)	0.05 (0.02)	0.00 (.)
31JAN83	0.00 (.)	0.00 (.)	0.05 (0.03)	0.00 (.)
21FEB83	0.00 (.)	0.00 (.)	0.04 (0.01)	0.00 (.)
10MAR83	0.00 (.)	0.00 (.)	0.05 (0.04)	0.00 (.)
28MAR83	0.00 (.)	0.00 (.)	0.29 (0.17)	0.00 (.)
11APR83	0.00 (.)	0.00 (.)	1.72 (0.09)	0.00 (.)
27APR83	0.00 (.)	0.00 (.)	0.64 (0.23)	0.00 (.)
11MAY83	0.00 (.)	0.00 (.)	0.68 (0.14)	0.02 (0.02)
31MAY83	0.00 (.)	0.00 (.)	0.32 (0.09)	0.00 (.)
24JUN83	0.00 (.)	4.57 (0.55)	0.00 (.)	0.00 (.)
13JUL83	0.00 (.)	24.49 (1.64)	0.00 (.)	0.00 (.)
28JUL83	0.00 (.)	15.15 (1.77)	0.00 (.)	0.00 (.)
09AUG83	0.01 (0.01)	7.66 (1.73)	0.00 (.)	0.00 (.)
26AUG83	1.16 (0.33)	75.44 (17.98)	0.00 (.)	0.00 (.)
12SEP83	3.95 (2.95)	2.80 (1.48)	0.00 (.)	0.00 (.)
03OCT83	0.00 (.)	0.02 (0.02)	10.28 (1.67)	0.00 (.)
13OCT83	0.03 (0.03)	0.00 (.)	0.77 (0.49)	0.00 (.)
28OCT83	0.00 (.)	0.00 (.)	0.05 (0.05)	0.00 (.)
29OCT83	0.00 (.)	0.00 (.)	0.07 (0.03)	0.00 (.)
02DEC83	0.00 (.)	0.00 (.)	0.02 (0.02)	0.00 (.)

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COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 4
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

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DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irroratus zoea	Cancer irroratus Megalop
22APR82	0.00 (0.00)	0.00 (.)	0.04 (0.04)	0.00 (.)
29APR82	0.00 (.)	0.00 (.)	7.50 (1.09)	0.00 (.)
24MAY82	0.00 (.)	0.00 (.)	0.04 (0.04)	0.00 (.)
30MAY82	0.00 (.)	0.84 (0.31)	0.06 (0.06)	0.00 (.)
08JUN82	0.00 (.)	8.30 (2.47)	0.00 (.)	0.00 (.)
21JUN82	0.01 (0.01)	1.78 (1.01)	0.00 (.)	0.00 (.)
12JUL82	0.00 (.)	13.47 (3.62)	0.00 (.)	0.00 (.)
30JUL82	0.04 (0.04)	30.37 (19.14)	0.00 (.)	0.00 (.)
04AUG82	0.23 (0.22)	11.31 (6.46)	0.00 (.)	0.00 (.)
18AUG82	0.01 (0.01)	0.50 (0.29)	0.00 (.)	0.00 (.)
30AUG82	0.00 (.)	2.80 (1.42)	0.00 (.)	0.00 (.)
16SEP82	0.00 (.)	0.60 (0.50)	0.00 (.)	0.00 (.)
24SEP82	0.00 (.)	0.06 (0.06)	0.00 (.)	0.00 (.)
07OCT82	0.02 (0.02)	0.00 (.)	0.37 (0.37)	0.00 (.)
15OCT82	0.00 (.)	0.00 (.)	0.02 (0.02)	0.00 (.)
29OCT82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
11NOV82	0.00 (.)	0.04 (0.02)	0.00 (.)	0.00 (.)
10DEC82	0.00 (.)	0.00 (.)	0.03 (0.02)	0.00 (.)
10MAR83	0.00 (.)	0.00 (.)	0.12 (0.12)	0.00 (.)
11APR83	0.00 (.)	0.00 (.)	0.16 (0.08)	0.00 (.)
27APR83	0.00 (.)	0.00 (.)	0.09 (0.06)	0.00 (.)
11MAY83	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
31MAY83	0.00 (.)	0.00 (.)	1.27 (0.44)	0.00 (.)
24JUN83	0.00 (.)	0.72 (0.12)	0.00 (.)	0.00 (.)
13JUL83	0.00 (.)	16.52 (1.82)	0.00 (.)	0.00 (.)
29JUL83	0.00 (.)	15.18 (8.34)	0.00 (.)	0.00 (.)
09AUG83	0.00 (.)	63.62 (1.70)	0.00 (.)	0.00 (.)
26AUG83	0.77 (0.55)	7.96 (5.15)	0.00 (.)	0.00 (.)
12SEP83	0.00 (.)	0.12 (0.07)	0.00 (.)	0.00 (.)
03OCT83	0.00 (.)	0.00 (.)	0.75 (0.67)	0.00 (.)
13OCT83	0.03 (0.03)	0.00 (.)	0.14 (0.05)	0.00 (.)
28OCT83	0.00 (.)	0.00 (.)	0.03 (0.02)	0.00 (.)

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COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 5
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irror atus zoea	Cancer irror atus Megalop
23MAY82	0.00 (.)	0.03 (0.03)	0.22 (0.22)	0.00 (.)
29MAY82	0.00 (.)	0.02 (0.02)	0.00 (.)	0.00 (.)
12JUL82	0.00 (.)	0.91 (0.35)	0.00 (.)	0.00 (.)
30JUL82	0.02 (0.01)	0.73 (0.33)	0.00 (.)	0.00 (.)
06AUG82	0.04 (0.02)	2.56 (1.50)	0.00 (.)	0.00 (.)
18AUG82	0.06 (0.02)	0.14 (0.08)	0.00 (.)	0.00 (.)
31AUG82	0.23 (0.13)	0.40 (0.23)	0.00 (.)	0.00 (.)
17SEP82	0.17 (0.06)	0.25 (0.10)	0.00 (.)	0.00 (.)
23SEP82	0.07 (0.04)	0.00 (.)	0.03 (0.03)	0.00 (.)
06OCT82	0.02 (0.01)	0.00 (.)	0.01 (0.01)	0.00 (.)
14OCT82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
28OCT82	0.00 (.)	0.00 (.)	0.16 (0.14)	0.00 (.)
12NOV82	0.00 (.)	0.01 (0.01)	0.00 (.)	0.00 (.)
18JAN83	0.00 (.)	0.01 (0.01)	0.00 (.)	0.00 (.)
07FEB83	0.00 (.)	0.00 (.)	0.03 (0.01)	0.00 (.)
11APR83	0.00 (.)	0.00 (.)	0.31 (0.15)	0.02 (0.02)
29APR83	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
26MAY83	0.00 (.)	0.00 (.)	0.07 (0.04)	0.00 (.)
30MAY83	0.00 (.)	0.00 (.)	0.02 (0.01)	0.00 (.)
21JUN83	0.00 (.)	0.21 (0.21)	0.00 (.)	0.00 (.)
12JUL83	0.00 (.)	2.40 (1.86)	0.00 (.)	0.00 (.)
29JUL83	0.02 (0.02)	1.73 (0.62)	0.00 (.)	0.00 (.)
12AUG83	0.01 (0.01)	0.01 (0.01)	0.00 (.)	0.00 (.)
25AUG83	0.25 (0.07)	3.10 (1.72)	0.00 (.)	0.00 (.)
13SEP83	0.20 (0.07)	0.34 (0.12)	0.00 (.)	0.00 (.)
26SEP83	0.04 (0.02)	0.28 (0.17)	0.00 (.)	0.00 (.)
28OCT83	0.02 (0.02)	0.00 (.)	0.04 (0.04)	0.00 (.)

COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 6
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irroratus zoea	Cancer irroratus Megalop
29MAY82	0.00 (.)	0.00 (0.00)	0.00 (.)	0.00 (.)
11JUN82	0.00 (.)	0.01 (0.01)	0.00 (.)	0.00 (.)
22JUN82	0.00 (.)	0.00 (.)	0.06 (0.06)	0.00 (.)
12JUL82	0.00 (.)	0.27 (0.10)	0.00 (.)	0.00 (.)
31JUL82	0.02 (0.01)	0.16 (0.07)	0.00 (.)	0.00 (.)
06AUG82	0.00 (.)	1.04 (0.49)	0.00 (.)	0.00 (.)
31AUG82	0.27 (0.24)	0.08 (0.08)	0.00 (.)	0.00 (.)
20SEP82	0.10 (0.06)	0.66 (0.38)	0.00 (.)	0.00 (.)
23SEP82	0.00 (.)	0.45 (0.44)	0.00 (.)	0.00 (.)
06OCT82	0.02 (0.01)	0.00 (.)	0.00 (.)	0.00 (.)
14OCT82	0.01 (0.01)	0.00 (.)	0.00 (.)	0.00 (.)
12NOV82	0.00 (.)	0.00 (.)	0.02 (0.01)	0.00 (.)
06APR83	0.00 (.)	0.00 (.)	0.08 (0.08)	0.00 (.)
26MAY83	0.00 (.)	0.01 (0.01)	0.00 (.)	0.00 (.)
29JUL83	0.00 (.)	0.44 (0.31)	0.00 (.)	0.00 (.)
12AUG83	0.00 (.)	0.68 (0.39)	0.00 (.)	0.00 (.)
25AUG83	0.12 (0.06)	0.63 (0.63)	0.92 (0.39)	0.00 (.)
13SEP83	1.09 (0.32)	0.00 (.)	0.06 (0.04)	0.00 (.)
26SEP83	0.04 (0.04)	0.06 (0.03)	0.00 (.)	0.00 (.)
14OCT83	0.00 (.)	0.03 (0.02)	0.00 (.)	0.00 (.)
26OCT83	0.00 (.)	0.00 (.)	0.05 (0.03)	0.00 (.)

COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 7
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irroratus zoea	Cancer irroratus Megalop
29APR82	0.00 (.)	0.00 (.)	0.06 (0.05)	0.00 (.)
29MAY82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
22JUN82	0.00 (.)	0.24 (0.24)	0.00 (.)	0.00 (.)
13JUL82	0.00 (.)	0.62 (0.33)	0.00 (.)	0.00 (.)
31JUL82	0.00 (.)	0.37 (0.18)	0.00 (.)	0.00 (.)
06AUG82	0.00 (.)	1.97 (0.23)	0.00 (.)	0.00 (.)
19AUG82	0.01 (0.01)	1.45 (0.79)	0.00 (.)	0.00 (.)
31AUG82	0.03 (0.02)	0.26 (0.16)	0.00 (.)	0.00 (.)
17SEP82	0.00 (.)	0.21 (0.07)	0.00 (.)	0.00 (.)
23SEP82	0.00 (.)	0.03 (0.02)	0.00 (.)	0.00 (.)
06OCT82	0.00 (.)	0.00 (.)	0.07 (0.07)	0.00 (.)
28OCT82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
08MAR83	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
06APR83	0.00 (.)	0.00 (.)	0.02 (0.02)	0.00 (.)
26MAY83	0.00 (.)	0.00 (.)	0.02 (0.02)	0.00 (.)
12JUL83	0.00 (.)	0.31 (0.22)	0.00 (.)	0.00 (.)
29JUL83	0.00 (.)	3.00 (0.63)	0.00 (.)	0.00 (.)
12AUG83	0.00 (.)	0.52 (0.32)	0.00 (.)	0.00 (.)
25AUG83	0.00 (.)	0.00 (.)	0.66 (0.19)	0.00 (.)
13SEP83	0.03 (0.03)	0.84 (0.18)	0.00 (.)	0.00 (.)
26SEP83	0.00 (.)	0.14 (0.09)	0.00 (.)	0.00 (.)
14OCT83	0.00 (.)	0.07 (0.07)	0.00 (.)	0.00 (.)

COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 8
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irroratus zoea	Cancer irroratus Megalop
17MAR82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
30MAR82	0.00 (.)	0.00 (.)	0.05 (0.05)	0.00 (.)
22APR82	0.00 (.)	0.00 (.)	0.70 (0.35)	0.00 (.)
19MAY82	0.00 (.)	0.00 (.)	0.02 (0.02)	0.00 (.)
30JUN82	0.00 (.)	13.76 (9.90)	0.11 (0.11)	0.00 (.)
22JUL82	0.28 (0.04)	26.44 (6.20)	0.00 (.)	0.00 (.)
12AUG82	0.12 (0.05)	12.98 (6.93)	0.00 (.)	0.00 (.)
09SEP82	0.37 (0.05)	3.27 (1.00)	0.00 (.)	0.00 (.)
20OCT82	0.01 (0.01)	0.00 (.)	0.00 (.)	0.00 (.)
18NOV82	0.02 (0.02)	0.00 (.)	0.00 (.)	0.00 (.)
26JAN83	0.00 (.)	0.00 (.)	0.00 (.)	0.01 (0.01)
30MAR83	0.00 (.)	0.00 (.)	0.49 (0.32)	0.00 (.)
21APR83	0.00 (.)	0.00 (.)	0.28 (0.04)	0.00 (.)
19MAY83	0.00 (.)	0.00 (.)	0.03 (0.02)	0.00 (.)
16JUN83	0.00 (.)	11.57 (8.09)	0.04 (0.04)	0.00 (.)
08JUL83	0.00 (.)	74.90 (21.38)	0.00 (.)	0.00 (.)
11AUG83	0.00 (.)	133.48 (8.24)	0.00 (.)	0.00 (.)
20SEP83	0.05 (0.02)	1.00 (0.20)	0.00 (.)	0.00 (.)
02NOV83	0.00 (.)	0.00 (.)	0.34 (0.16)	0.00 (.)
10DEC83	0.00 (.)	0.00 (.)	0.22 (0.14)	0.00 (.)

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COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 8
MEAN OF 4 353 U NEUSTON TOWS IN NOS PER METER CUBED (STD ERROR)

****

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irror atus zoea	Cancer irror atus Megalop
17MAR82	0.00 (.)	0.00 (.)	0.02 (0.02)	0.00 (.)
22APR82	0.00 (.)	0.00 (.)	0.03 (0.02)	0.00 (.)
19MAY82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
30JUN82	0.00 (.)	29.77 (14.29)	0.00 (.)	0.00 (.)
22JUL82	1.57 (0.75)	3.51 (1.61)	0.00 (.)	0.00 (.)
12AUG82	0.14 (0.05)	14.03 (2.64)	0.00 (.)	0.00 (.)
09SEP82	0.24 (0.11)	0.56 (0.12)	0.00 (.)	0.00 (.)
20OCT82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
18NOV82	0.00 (.)	0.00 (.)	0.02 (0.02)	0.00 (.)
30NOV82	0.02 (0.02)	0.00 (.)	0.10 (0.03)	0.04 (0.04)
09FEB83	0.00 (.)	0.00 (.)	0.00 (0.00)	0.00 (.)
30MAR83	0.00 (.)	0.00 (.)	0.10 (0.04)	0.00 (.)
21APR83	0.00 (.)	0.00 (.)	0.02 (0.01)	0.00 (.)
19MAY83	0.02 (0.01)	0.00 (.)	0.09 (0.04)	0.00 (.)
16JUN83	0.00 (.)	0.68 (0.34)	0.00 (.)	0.00 (.)
08JUL83	0.00 (.)	19.26 (5.31)	0.00 (.)	0.00 (.)
11AUG83	0.01 (0.01)	1.09 (0.82)	0.64 (0.46)	0.00 (.)
20SEP83	0.01 (0.01)	0.00 (.)	0.00 (.)	0.00 (.)
02NOV83	0.00 (.)	0.00 (.)	0.00 (0.00)	0.00 (.)
23NOV83	0.00 (.)	0.00 (.)	0.00 (.)	0.00 (0.00)
10DEC83	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)

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COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 9
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irror atus zoea	Cancer irror atus Megalop
19MAY82	0.00 (.)	0.00 (.)	0.07 (0.07)	0.00 (.)
30JUN82	0.00 (.)	3.11 (0.36)	0.00 (.)	0.00 (.)
22JUL82	0.00 (.)	317.43 (122.71)	0.07 (0.07)	0.00 (.)
12AUG82	0.04 (0.04)	110.15 (16.60)	0.00 (.)	0.00 (.)
09SEP82	0.19 (0.09)	0.18 (0.18)	0.23 (0.11)	0.00 (.)
20OCT82	0.00 (.)	0.00 (.)	0.25 (0.12)	0.00 (.)
18NOV82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
24NOV82	0.00 (.)	0.00 (.)	0.02 (0.01)	0.01 (0.01)
30NOV82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
09FEB83	0.00 (.)	0.00 (.)	0.03 (0.02)	0.00 (.)
21FEB83	0.00 (.)	0.00 (.)	0.13 (0.05)	0.00 (.)
30MAR83	0.00 (.)	0.00 (.)	1.96 (0.28)	0.00 (.)
21APR83	0.00 (.)	0.00 (.)	0.08 (0.07)	0.00 (.)
27APR83	0.00 (.)	0.00 (.)	0.57 (0.16)	0.00 (.)
19MAY83	0.00 (.)	0.06 (0.03)	0.00 (.)	0.00 (.)
16JUN83	0.00 (.)	2.81 (1.28)	0.12 (0.12)	0.00 (.)
08JUL83	0.00 (.)	212.65 (58.19)	0.00 (.)	0.00 (.)
28JUL83	0.00 (.)	75.07 (26.20)	0.09 (0.09)	0.00 (.)
11AUG83	0.03 (0.01)	273.04 (63.21)	0.00 (.)	0.00 (.)
26AUG83	0.90 (0.59)	16.22 (3.21)	0.00 (.)	0.00 (.)
20SEP83	0.00 (.)	5.09 (1.19)	0.26 (0.26)	0.00 (.)
03OCT83	0.04 (0.04)	0.05 (0.03)	0.00 (.)	0.00 (.)
02NOV83	0.00 (.)	0.00 (.)	0.07 (0.04)	0.00 (.)
18NOV83	0.00 (.)	0.00 (.)	0.03 (0.02)	0.00 (.)
23NOV83	0.00 (.)	0.00 (.)	0.00 (.)	0.04 (0.03)
10DEC83	0.00 (.)	0.02 (0.02)	0.00 (.)	0.00 (.)

COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 9
MEAN OF 4 353 U NEUSTON TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer Irror atus zoea	Cancer Irror atus Megalop
30MAR82	0.00 (.)	0.00 (.)	0.01 (0.01)	0.00 (.)
19MAY82	0.00 (.)	0.00 (.)	0.02 (0.00)	0.00 (.)
30JUN82	0.00 (.)	2.40 (0.54)	0.00 (.)	0.00 (.)
22JUL82	2.47 (1.94)	267.81 (93.76)	0.00 (.)	0.00 (.)
12AUG82	0.03 (0.03)	122.28 (38.56)	0.00 (.)	0.00 (.)
09SEP82	0.98 (0.31)	0.03 (0.01)	0.00 (.)	0.00 (.)
20OCT82	0.07 (0.03)	0.00 (.)	0.09 (0.03)	0.00 (.)
30MAR83	0.00 (.)	0.00 (.)	0.08 (0.03)	0.00 (.)
21APR83	0.00 (.)	0.00 (.)	0.22 (0.06)	0.00 (.)
19MAY83	0.01 (0.01)	0.00 (.)	0.13 (0.08)	0.00 (.)
16JUN83	0.00 (0.00)	11.12 (0.99)	0.00 (.)	0.00 (.)
08JUL83	0.00 (.)	400.03 (178.32)	0.00 (.)	0.00 (.)
11AUG83	0.46 (0.28)	8.63 (3.19)	0.00 (.)	0.00 (.)
20SEP83	0.00 (.)	0.00 (.)	0.25 (0.15)	0.00 (.)
02NOV83	0.00 (.)	0.00 (0.00)	0.00 (.)	0.00 (.)

COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 10
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer Irroratus zoea	Cancer Irroratus Megalop
17MAR82	0.00 (.)	0.00 (.)	0.00 (0.00)	0.00 (.)
22APR82	0.00 (.)	0.00 (.)	0.99 (0.31)	0.00 (.)
19MAY82	0.00 (.)	0.00 (.)	1.01 (0.20)	0.00 (.)
30JUN82	0.00 (.)	14.96 (5.71)	0.05 (0.05)	0.00 (.)
26JAN83	0.00 (.)	0.00 (.)	0.09 (0.04)	0.00 (.)
09FEB83	0.00 (.)	0.00 (.)	0.11 (0.05)	0.00 (.)
30MAR83	0.00 (.)	0.00 (.)	0.18 (0.12)	0.00 (.)
21APR83	0.00 (.)	0.00 (.)	8.72 (1.97)	0.00 (.)
19MAY83	0.00 (.)	0.00 (.)	0.93 (0.52)	0.00 (.)
16JUN83	0.00 (.)	54.18 (30.95)	0.05 (0.05)	0.00 (.)
08JUL83	0.00 (.)	86.32 (12.00)	0.00 (.)	0.00 (.)
11AUG83	0.00 (.)	64.32 (28.58)	0.00 (.)	0.00 (.)
20SEP83	0.00 (.)	0.04 (0.04)	0.00 (.)	0.00 (.)
11DEC83	0.00 (.)	0.00 (.)	0.03 (0.03)	0.00 (.)

COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION 10
MEAN OF 4 353 U NEUSTON TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer Irroratus zoea	Cancer Irroratus Megalop
22APR82	0.00 (.)	0.00 (.)	0.34 (0.23)	0.00 (.)
19MAY82	0.00 (.)	0.00 (.)	1.08 (0.11)	0.00 (.)
30JUN82	0.00 (.)	19.53 (4.72)	0.00 (.)	0.00 (.)
22JUL82	0.08 (0.07)	7.50 (3.91)	0.00 (.)	0.00 (.)
12AUG82	0.08 (0.08)	88.21 (28.69)	0.00 (.)	0.00 (.)
09SEP82	0.00 (.)	7.56 (3.39)	0.04 (0.04)	0.00 (.)
20OCT82	0.01 (0.01)	0.00 (.)	0.02 (0.01)	0.00 (0.00)
18NOV82	0.00 (.)	0.00 (.)	0.00 (0.00)	0.00 (.)
30NOV82	0.01 (0.01)	0.00 (.)	0.50 (0.06)	0.00 (.)
30MAR83	0.00 (.)	0.00 (.)	0.33 (0.26)	0.00 (.)
21APR83	0.00 (.)	0.00 (.)	0.01 (0.00)	0.00 (.)
19MAY83	0.01 (0.01)	0.00 (.)	0.11 (0.05)	0.00 (.)
16JUN83	0.00 (.)	3.31 (2.13)	0.00 (.)	0.00 (.)
08JUL83	0.00 (.)	6.82 (1.85)	0.00 (.)	0.00 (.)
11AUG83	0.00 (.)	15.47 (5.39)	0.00 (.)	0.00 (.)
20SEP83	0.00 (.)	0.04 (0.02)	0.00 (.)	0.00 (.)
02NOV83	0.00 (.)	0.01 (0.01)	0.00 (.)	0.00 (.)
19NOV83	0.00 (.)	0.00 (.)	0.06 (0.02)	0.00 (.)

COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION DS
MEAN OF 4 353 U OBLIQUE TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer irroratus zoea	Cancer irroratus Megalop
30MAR82	0.00 (.)	0.00 (.)	0.05 (0.03)	0.00 (.)
21APR82	0.00 (.)	0.00 (.)	1005.69 (179.93)	0.00 (.)
18MAY82	0.00 (.)	0.03 (0.03)	0.66 (0.05)	0.00 (.)
29JUN82	0.00 (.)	17.84 (6.47)	0.00 (.)	0.00 (.)
21JUL82	0.15 (0.08)	15.79 (7.76)	0.00 (.)	0.00 (.)
11AUG82	1.47 (0.18)	747.32 (176.07)	0.00 (.)	0.00 (.)
08SEP82	0.39 (0.11)	0.30 (0.11)	0.00 (.)	0.00 (.)
19OCT82	0.06 (0.05)	0.00 (.)	0.14 (0.08)	0.00 (.)
17NOV82	0.00 (.)	0.00 (.)	0.67 (0.34)	0.04 (0.04)
30NOV82	0.00 (.)	0.04 (0.04)	0.08 (0.05)	0.00 (.)
08FEB83	0.00 (.)	0.00 (.)	0.72 (0.16)	0.00 (.)
29MAR83	0.00 (.)	0.00 (.)	11.75 (2.27)	0.00 (.)
23APR83	0.00 (.)	0.00 (.)	136.21 (16.13)	0.00 (.)
18MAY83	0.03 (0.02)	0.00 (.)	7.88 (2.33)	0.00 (.)
14JUN83	0.01 (0.01)	1.09 (0.14)	0.10 (0.06)	0.00 (.)
07JUL83	0.00 (.)	5.46 (0.91)	0.00 (.)	0.00 (.)
10AUG83	0.00 (.)	9.84 (0.62)	0.00 (.)	0.00 (.)
19SEP83	1.69 (0.26)	71.52 (2.47)	0.00 (.)	0.00 (.)
10DEC83	0.00 (.)	0.00 (.)	0.07 (0.02)	0.00 (.)

COMMERCIAL CRUSTACEANS
SUMMARY OF TOWS AT STATION DS
MEAN OF 4 353 U NEUSTON TOWS IN NOS PER METER CUBED (STD ERROR)

DATE	Callinectes sp. Megalopa	Callinectes sp. Zoea	Cancer Irroratus zoea	Cancer Irroratus Megalop
21APR82	0.00 (.)	0.00 (.)	0.45 (0.16)	0.00 (.)
18MAY82	0.00 (.)	0.00 (.)	0.07 (0.05)	0.00 (0.00)
29JUN82	0.00 (0.00)	19.23 (7.99)	0.00 (0.00)	0.00 (0.00)
21JUL82	98.97 (49.15)	63.18 (13.28)	0.00 (.)	0.01 (0.01)
11AUG82	53.70 (27.40)	373.89 (47.73)	0.00 (.)	0.00 (0.00)
08SEP82	12.61 (6.90)	0.03 (0.01)	0.00 (.)	0.00 (.)
19OCT82	0.23 (0.03)	0.00 (.)	1.54 (0.59)	0.00 (.)
17NOV82	0.01 (0.01)	0.01 (0.01)	0.09 (0.07)	1.11 (0.06)
30NOV82	0.00 (.)	0.00 (.)	0.22 (0.09)	0.00 (.)
08FEB83	0.00 (.)	0.00 (.)	0.19 (0.04)	0.00 (.)
29MAR83	0.00 (.)	0.00 (.)	1.35 (0.80)	0.00 (.)
23APR83	0.00 (.)	0.00 (.)	0.02 (0.01)	0.00 (0.00)
18MAY83	0.00 (.)	0.00 (.)	0.23 (0.05)	0.00 (.)
14JUN83	0.02 (0.01)	2.37 (0.19)	0.01 (0.01)	0.00 (.)
07JUL83	0.00 (0.00)	46.18 (11.88)	0.00 (.)	0.00 (.)
10AUG83	0.01 (0.00)	157.00 (52.14)	0.00 (.)	0.00 (.)
19SEP83	3.69 (0.62)	3.53 (0.51)	0.00 (.)	0.00 (.)
10DEC83	0.00 (.)	0.00 (.)	0.00 (0.00)	0.00 (.)

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